■ SOIL VAPOR EXTRACTION
PILOT STUDY REPORT
VERSION 3.1
MOTOR POOL AREA
ROCKY MOUNTAIN
ARSENAL





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Prepared for U.S. Department of the Army Corps of Engineers, Omaha District Omaha, Nebraska March 1992



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1.0 INTRODUCTION

This Soil Vapor Extraction Pilot Study Report for the Motor Pool Area at the Rocky Mountain Arsenal (RMA) is being prepared as part of the Interim Response Action (IRA) process in accordance with the Federal Facility Agreement and the Technical Program Plan. Determinations concerning the implementation of this IRA have been reached through a consideration of the objectives of Sections 2.3(a), 22.5, and 22.6 of the Federal Facility Agreement and by application of the Decision Flow Chart for Other Contamination Sources IRAs adopted by the Organizations and the State in the June 7, 1989 Subcommittee meeting (WCC 1990).

An alternatives assessment was conducted as part of the IRA process in the fall of 1989. The recommended action at the Motor Pool area was to address contaminated soil with in situ soil vapor extraction and to address contaminated ground water through the use of a pump and treat system in conjunction with a Shell-led IRA which addresses a dibromochloropropane plume emanating from the rail classification yard. This document presents the results of the Soil Vapor Extraction (SVE) Pilot Study conducted between July and December, 1991 at the Motor Pool Area.

An Implementation Document was finalized in February, 1991 which outlined the pilot study plan for soil vapor extraction in the Motor Pool Area. The primary objective of this program was to collect data on the performance of SVE at this site. These data could be used to expand the soil vapor extraction system, if necessary. A secondary objective was to begin removing contaminants from the soil in the area. Section 2.0 of this report outlines the site history, a summary of previous investigations, and the nature and extent of contamination. Section 3.0 presents the technical approach to the pilot system design, including the data collection program and the rationale for evaluating system performance. Section 4.0 presents the test results of the pilot program including an analysis of the data. Section 5.0 presents the conclusions gathered from the pilot program. Appendix A presents the well construction details including soil boring logs and geologic cross sections. Appendix B presents raw analytical results from the SVE sampling program.

2.0

SITE BACKGROUND AND INTERIM ACTION INVESTIGATION

This section presents background information on the Motor Pool Area, including site history and the nature and extent of contamination based on previous field investigations. The October 1990 soil investigation and the scope and objectives of the pilot test are also discussed.

2.1 SITE DESCRIPTION

2.1.1 Location

Rocky Mountain Arsenal (RMA) occupies more than 17,000 acres (approximately 27 square miles) in Adams County, directly northeast of metropolitan Denver, Colorado (Figure 2-1). The Motor Pool Area consists of the developed area in the southeastern corner of Section 4 on the RMA. The Motor Pool Area is located near the rail yard, on the west side of the boundary line between Sections 3 and 4, and is approximately 650 feet (east-west) by 2,300 feet (north-south). Structures within the site include 7 above-ground fuel and oil storage tanks, 26 buildings and foundations for 3 buildings that have been removed. The structures consist of administration buildings, motor vehicle storage and maintenance buildings, warehouses, railroad roundhouse and tracks, former agricultural research buildings, fuel storage tanks, fuel station, and a groundwater well pumphouse (Figure 2-2).

2.1.2 History

Prior to 1942, the Motor Pool Area consisted of farm land that was used to produce wheat and corn, or was used as grass land for hay and grazing of cattle. The Motor Pool Area was acquired by the U.S. Army in 1942 as part of RMA. Railroad spurs into the study area, entering across the northwest and southern boundaries, were built during the initial construction of RMA (Ebasco 1989a).

Most of the structures in the study area were built by the Army during the initial construction period of 1942 to 1943. During this period, a sanitary sewer system was constructed that extended north from the Motor Pool and rail yard areas. Portions of the sewer ended in septic tanks and leach fields. In 1945, construction of the sewer was completed with the installation of two pump stations and a pressure pipe that discharged eastward to an outfall into the interceptor line north of the Administration area.

Since the 1940s, the Motor Pool Area has been used by RMA for servicing equipment, vehicles, and railroad cars, as well as for storing fuel, road oil, and flammable liquids.

The roundhouse (Building 631) has been in use since the beginning of operations at RMA in 1942. It has been used for the maintenance of locomotives, railcars, and other heavy equipment. Solvents used to clean parts and surfaces may have been discharged either to a ditch east of the roundhouse or to a septic tank. From 1968 to 1982, the building was used by the U.S. Army reserve units for vehicle maintenance. From 1975 to 1985, it was occasionally used as a repair shop for earth-moving equipment. A small structure for storing cleaning solvents and paint thinners, which were used in Building 631, is attached to Building 631.

Previous Motor Pool Area investigative studies include: a May 1984 Resource Conservation and Recovery Act (RCRA) audit by the Colorado Department of Health (Ebasco 1989a) in the area outside the roundhouse; a 1986 study to identify possible trichloroethylene (TCE) sources in the Motor Pool Area (Ebasco 1988); and a soil gas study conducted in February 1986 to aid in defining the presence of trichloroethylene in the groundwater (Ebasco 1987). The most recent studies include the Contamination Assessment Report (Ebasco 1988); the Western Study Area Report (Ebasco 1989a); a soil gas survey conducted in summer 1989 (WCC 1989), and a pre-design data collection program in October 1990 (WCC 1991a).

2.1.3 Site Geology

The Motor Pool Area is in Section 4 near the western boundary of the RMA. The ground surface in the study area is essentially flat with a nominal slope toward the northwest. There are two stratigraphic units of interest beneath the Motor Pool Area:

the Quaternary Alluvium and the Denver Formation. The alluvial material consists of discontinuous lenses of sand and gravel, interbedded with silt and clay. Gravels and gravelly sands are common at the base of the alluvial section, especially in paleochannels. The alluvial material ranges from about 70 feet to about 100 feet in thickness. Groundwater has been observed at between 60 and 70 feet below ground surface. The thickest alluvium occurs over bedrock lows, and the thinnest over bedrock highs.

The alluvium-bedrock contact is highly irregular due to the extensive erosion that was caused by ancient stream channels, which preceded the deposition of the alluvium. Generally, the bedrock surface slopes to the northwest in the Motor Pool Area; however, where the bedrock surface has been incised by an ancient stream channel, the slope becomes perpendicular to the trend of the paleochannel. A northwest trending paleochannel cuts across the northern boundary of the Motor Pool Area and has approximately 70 feet of relief.

The Denver Formation in the Motor Pool Area is predominantly composed of claystone with interbedded sandstone, siltstone, and lignite layers that vary from about 2 feet to approximately 20 feet thick. Layers of volcaniclastics are also present in the bedrock (Ebasco 1989a).

2.2 NATURE AND EXTENT OF CONTAMINATION

A summary of the nature and extent of contaminants found in the Motor Pool Area is discussed in this section. Information used in this summary was obtained from previous studies, including a soil gas investigation conducted in February 1986 to aid in defining trichloroethylene plumes in the groundwater (Ebasco 1987), a Contamination Assessment Report (Ebasco 1988), the Western Study Area Report (Ebasco 1989a), a soil gas survey conducted in summer 1989 (WCC 1990), and a pre-design data collection program in October 1990 (WCC 1991a). These reports can be referenced for additional details.

2.2.1 Soil Contamination

The soils investigations of the Motor Pool Area have been in three general areas:

- Repair, salvage, and surplus facility (Building 624) and railroad roundhouse (Building 631) areas
- Motor Pool and vehicle maintenance facility (Building 627) area
- Fuel tank storage area

The analytical data were derived from soil samples taken at various depths in the vadose zone. Sampling depths in the boreholes were generally 0 to 1, 4 to 5, 9 to 10, 14 to 15, and 19 to 20 feet. Borings greater than 20 feet in depth were sampled at 10-foot intervals below the 20 foot depth. A summary of the analytical results is shown in Table 2-1.

Indicator levels and ranges were established to assess the significance of organic and metal analytical values. Organic compound indicator levels are set at the certified reporting limit (CRL) for each compound. Metal indicator ranges are set within naturally occurring levels in the alluvial soils at RMA. These indicator ranges are shown in Table 2-1. A more detailed discussion of the selection of the indicator ranges can be found in the Introduction to the Contamination Assessment Reports (ESE 1987).

Trichloroethylene was detected in the area between the roundhouse (Building 631) and Building 624, in a near-surface soil sample taken beneath a man-made drainage ditch. This suggests that, at some time in the past, chlorinated solvents used at these facilities were present in the north-trending ditch.

Concentrations of ICP metals (cadmium, chromium, copper, lead, and zinc) and arsenic above background levels were also found in near-surface soil samples taken from beneath the ditch. This is attributed to the sanding and paint stripping operations performed during equipment maintenance and repair (Final Contaminant Assessment Report, Ebasco, July 1988).

Methylene chloride, trichloropropene, and aldrin were present in soil samples taken near the roundhouse (Table 2-1).

At Building 627, tetrachloroethylene was detected between 18 and 30 feet below grade beneath the same north trending ditch that passes between Building 624 and the roundhouse. These detections may suggest infiltration from the upgradient discharges at the roundhouse and Building 624.

Dibromochloropropane, toluene, and benzothiazole were found in near-surface soil samples taken downgradient from a drainage pipe exiting the south side of Building 627. The drain pipe discharged hot water and detergent in the mid-1960s and diluted wastes from the wash bay since 1951 (Ebasco 1989a).

Methylnaphthalene, pyrene, and fluoranthene were detected in near-surface soil samples taken in the north trending ditch west of Buildings 624 and 627. These analytes are attributed to leaching from railroad ties that had been treated with wood preservatives (Ebasco 1989a).

The fuel tank storage area is located west of Building 627 and consists of seven above-ground tanks. Soil samples from the area showed the following analytes to be present in the near-surface soils (concentrations are summarized in Table 2-1):

- Methylcyclohexane
- Benzene
- Ethylbenzene
- m-Xylene
- Toluene
- Methylnaphthalene

Lead and zinc occurred in surface soils at concentrations slightly exceeding their indicator ranges.

2.2.2 Previous Soil Gas Surveys

Three soil gas investigations have been conducted in the Motor Pool Area to locate organic contaminants. The first soil gas program was conducted in early 1986 (Ebasco 1987) when groundwater sampling had initially detected trichloroethylene near the roundhouse and Building 624. The trichloroethylene soil gas data showed a trichloroethylene soil vapor plume extending northwest from the Motor Pool Area. Another 1986 soil gas program used static samplers over a 1-month period. This study confirmed previous study results (Ebasco 1987).

The most recent soil gas investigation of the Motor Pool Area was conducted in July 1989. Eighty soil gas samples and 6 soil samples were collected in the study area. Sampling depths were 5, 10, 15, and 20 feet below grade, with a standard sampling depth of 5 feet. Sampling results are shown in Figure 2-3.

The volatile organic compounds that were analyzed for at each of the sampling locations included:

- Trichloroethylene (TCE)
- Trans 1,2 Dichloroethylene
- Cis 1,2 Dichloroethylene
- 1,1 Dichloroethylene
- Benzene
- Toluene
- Ethyl benzene
- o, m, p-Xylene

Measured concentrations of TCE in soil gas ranged from the detection limit (0.01 μ g/l) to about 600 μ g/l, with concentrations of TCE typically greater than 200 μ g/l in the soil gas between Buildings 624 and 625. Figures 2-3 and 2-4 show the results of the grid sampling conducted in 1989. Additional samples taken in the immediate vicinity of building 624 are presented in tabular form in the field investigation report (WCC 1989).

Evidence seems to indicate that the origin of this TCE contamination is a 3-inch diameter floor drain, shown on 1942 plumbing plans of Building 624, that leads to an outside ditch located between Buildings 624 and 625. TCE was used as a degreasing agent in Building 624.

2.2.3 Groundwater Contamination

Groundwater in the Motor Pool area is 60 to 65 feet below the ground surface (Ebasco 1989a). During the soil gas survey conducted in 1986 at the Motor Pool Area, high TCE concentrations were detected near Buildings 624 and 631 (Ebasco 1987). Groundwater samples from the nearby alluvial wells detected TCE. From these data, the trichloroethylene alluvial groundwater plume is interpreted to originate in the Motor Pool Area and extend to the north-northwest (Figure 2-5). None of the Denver Formation wells in the western study area detected TCE. This finding suggests that the plume is confined in the upper portion of the unconfined aquifer at this site. Refer to the Remedial Investigation Final Report (Ebasco 1989a) for a detailed discussion on the groundwater contamination originating from the Motor Pool Area.

2.3 OCTOBER 1990 SOIL INVESTIGATION

Previous soil investigations at the Motor Pool Area have detected TCE in the soil (Table 2-1). Soil gas surveys in the area have found TCE in soil gas (Figure 2-3). Groundwater investigations have consistently detected elevated levels of TCE in groundwater in the Motor Pool Area (Ebasco 1989a). However, those investigations did not provide the information necessary to design a soil vapor extraction system. Therefore, a focused soil investigation was performed at the Motor Pool Area in October 1990.

The objective of this study was to further characterize the lateral and vertical extent of volatile halogenated organics (VHOs) in soil immediately to the west of Buildings 624 and 625, for purposes of collecting baseline information for the SVE system evaluation. A total of five borings were drilled and sampled at five-foot intervals between ground surface and groundwater. The samples were analyzed for VHOs. The boring locations (Figure 2-6) were selected to characterize the apparent plume observed during the 1989 soil gas survey (Figure 2-4).

Carbon-tetrachloride (CCl₄) was the only target analyte detected in the soil samples collected. The sample taken from boring COEMPA0005 from the 18 to 19 foot interval indicated CCl₄ at a concentration of 0.592 μ g/g. The duplicate sample collected from the 17 to 18 foot interval reported CCl₄ as less than (LT) the certified reporting limit indicating the possibility the detection of this compound was due to a lab contaminant. All other samples were reported as LT for all the VHO target analytes.

Two of the borings (COEMPA0001 and COEMPA0002) were completed as soil gas extraction wells (VES-1 and VES-2, respectively). Well construction details can be found in the Implementation Document. These wells were used to conduct an initial air permeability test to establish a relationship between soil gas flow rate and vacuum applied at the well heads. This information, along with the analytical data from the soil investigation, were used to design the pilot system.

2.4 SCOPE OF PILOT PROGRAM

The five-month pilot program described in Section 3.0 focused on applying Soil Vapor Extraction to a volume of soil which has been shown to contain elevated levels of TCE in the soil gas. The soil vapor extraction wells used for the pilot program (VES-3 and VES-4) are located near the northwest corner of Building 624, approximately corresponding to the highest concentrations of TCE in soil gas detected in the 1989 soil gas survey. The soil to be addressed during the pilot test extends from the surface to groundwater, approximately 63 feet below ground surface.

The pilot program collected engineering data to confirm estimates of flow rate for the extraction wells and the radius of influence from each well. Soil permeability data was obtained when extracting from both wells to confirm the preliminary results gathered in a previous one-day study. Results of soil gas analyses were used with these data to estimate the quantitative effectiveness of vapor extraction at varying depths at this site.

Sheet 1 of 3

TABLE 2-1

SUMMARY OF SOIL SAMPLE ANALYTICAL RESULTS MOTOR POOL AREA

Frequency Analytical Groups and Analytes Detected Detections	Frequency of Detections ¹	Range (µg/g)	CRL Range $(\mu g/g)^{12}$	Indicator Range (μg/l)
Organochlorine Pesticides Aldrin	2/163	0.9-3	0.3	
Arsenic	16/152	2.6-27	2.5-5	CRL-10
Mercury	14/152	0.057-0.38	0.050-0.060	CRL-0.1
ICP Metals Cadmium Chromium Copper Lead Zinc DBCP Polynuclear Aromatic Hydrocarbons Fluoranthene* Pyrene* Methyl naphthalene*	13/152 62/152 100/152 37/152 146/152 1/177 5/163 6/163 8/163	1.4-30 6.5-490 5.7-220 9.8-2000 11-2300 0.01 1-30 0.5-20 4-200	0.66-0.74 5.2-6.5 4.7-4.9 8.4-13 8.7-9.5 0.0050 0.3* 0.3* 0.3*	1-2 25-40 20-35 25-40 60-80

Sheet 2 of 3

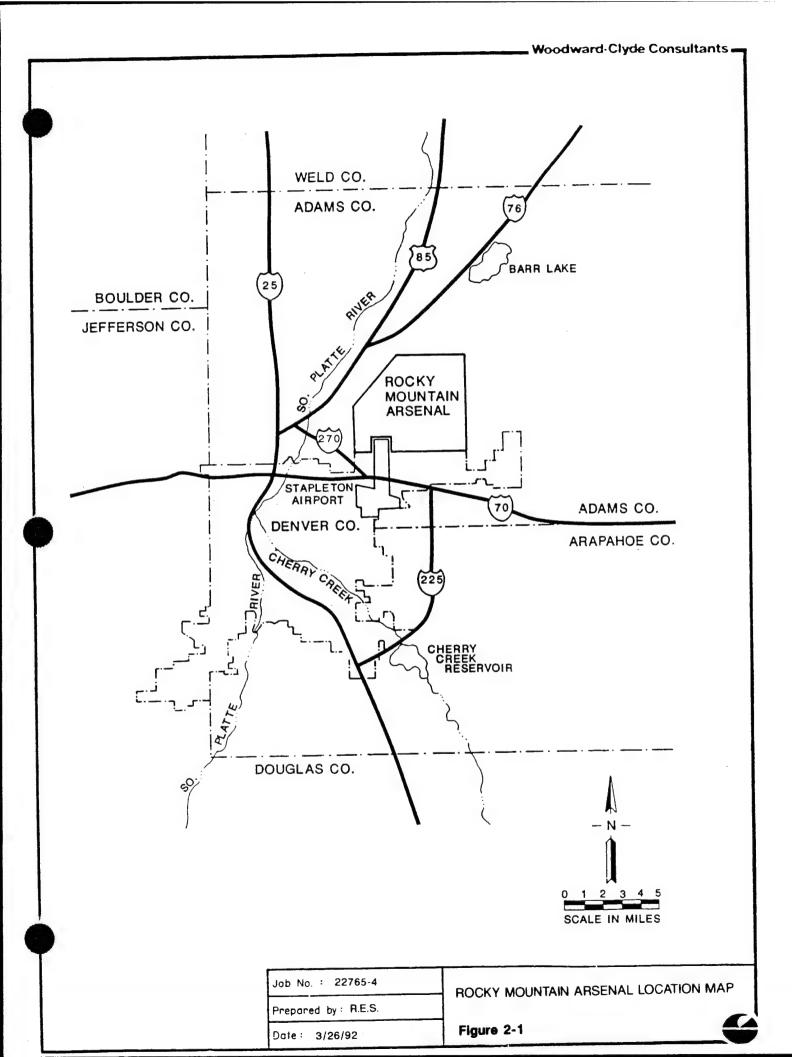
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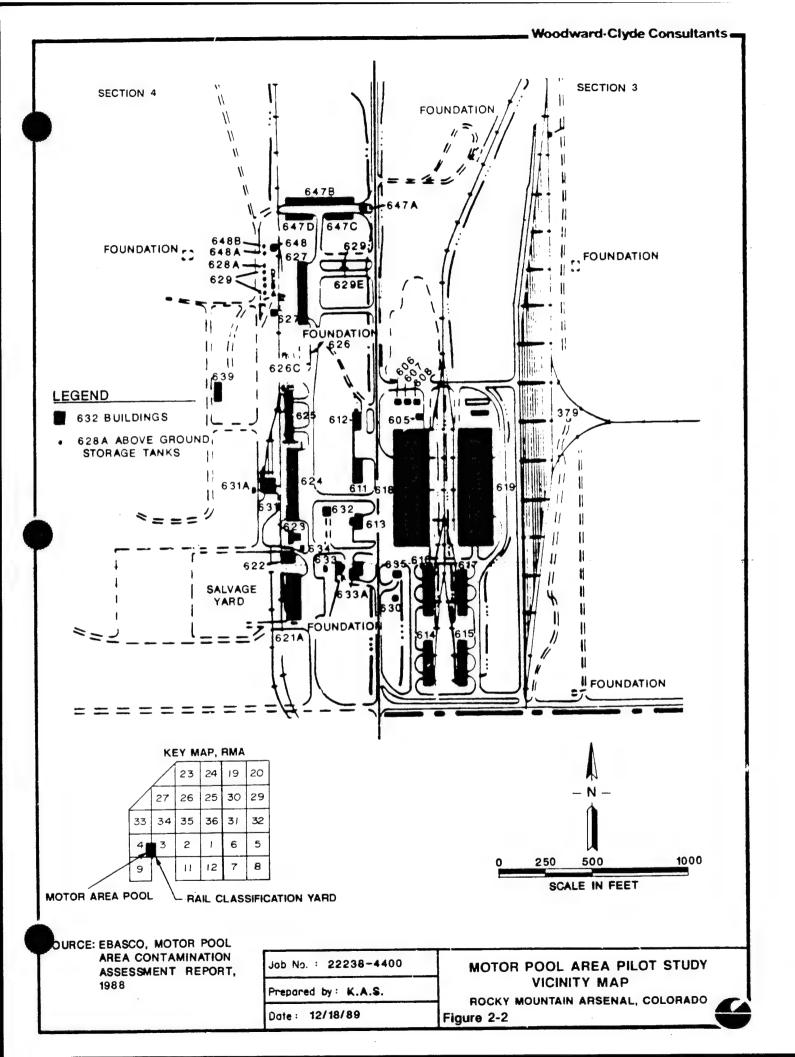
Analytical Groups and Analytes Detected	Frequency of Detections ¹	Range (ug/g)	CRL Range (ug/g) ^{/2}	Indicator Range (ug/1)
Volatile Halogenated Organics	3/135	0.4-1	0.3	
Trichloroethylene Trichloropropene*	1/135 1/135 1/135	2 0.2	0.3-0.5	
Methylene Chloride	1/135	3	0.7-2	
<u>Volatile_Hydrocarbons</u> 4-Hydroxy-4-methyl-2-pentanone* Methylcyclohexane*	1/135 2/135	4 2-10	0.3* 0.3*	
Volatile Aromatic Organics Ethylbenzene m-Xylene Toluene	1/135 1/135 2/135	4 2 2-4	0.3-0.4 0.7-0.8 0.3	
Organosulfur Compounds Benzothiozole	1/163	0.3	0.3*	

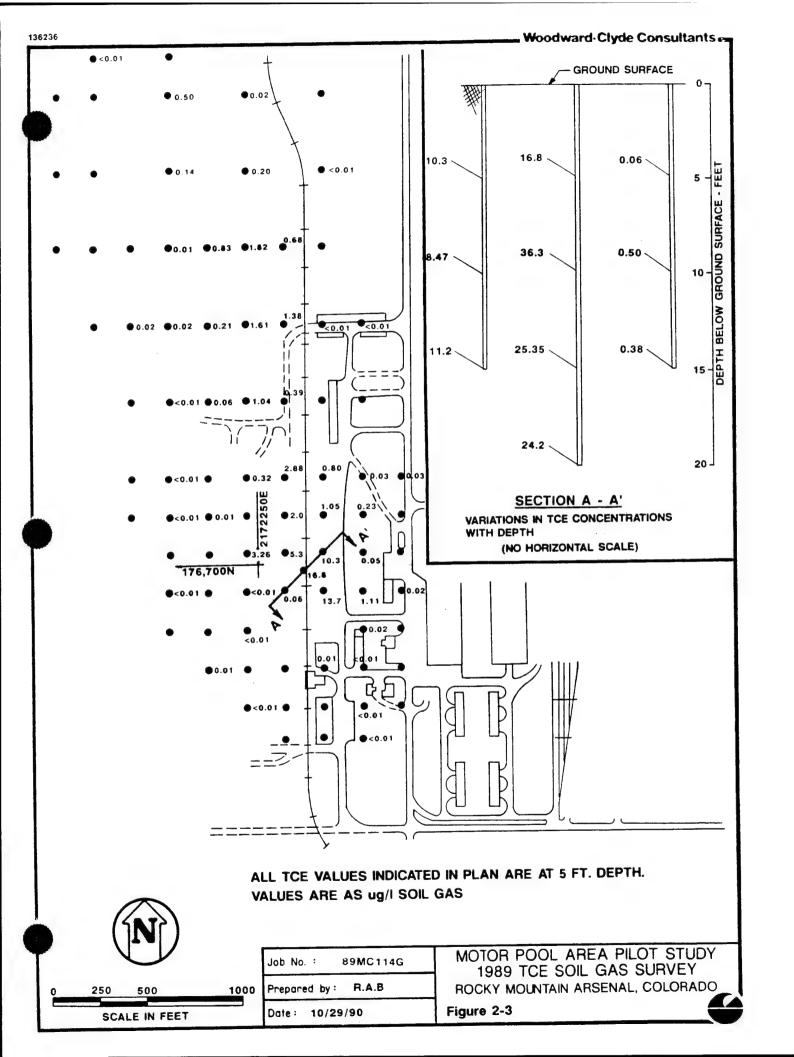
 $\mu g/g$ - Micrograms per gram

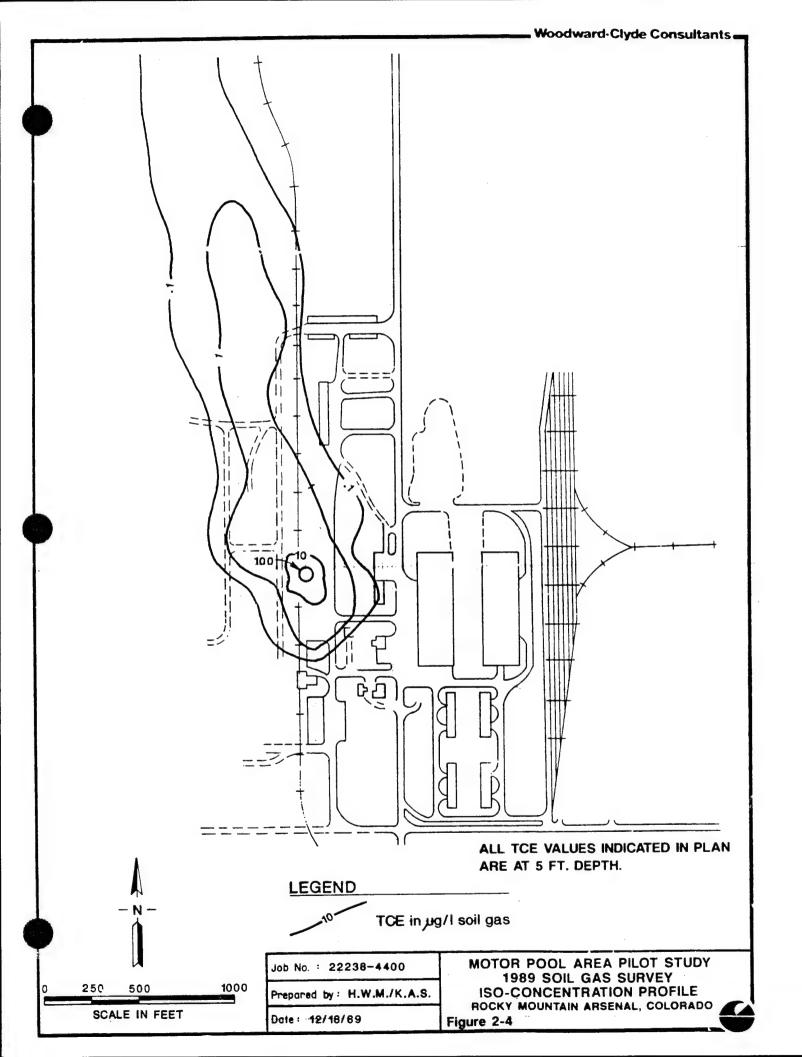
- which occasionally has occurred when more than one analytical method has been used. Total number of borings, 36; Fraction represents the total number of samples with detections of an analyte in relation to the number of analyses conducted on all samples. This value does not include multiple detections of a specific analyte in the same sample, total number of samples, 165.
 - Certified Reporting Limit (CRL) or detection limit which varies among laboratories conducting analyses.
- There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

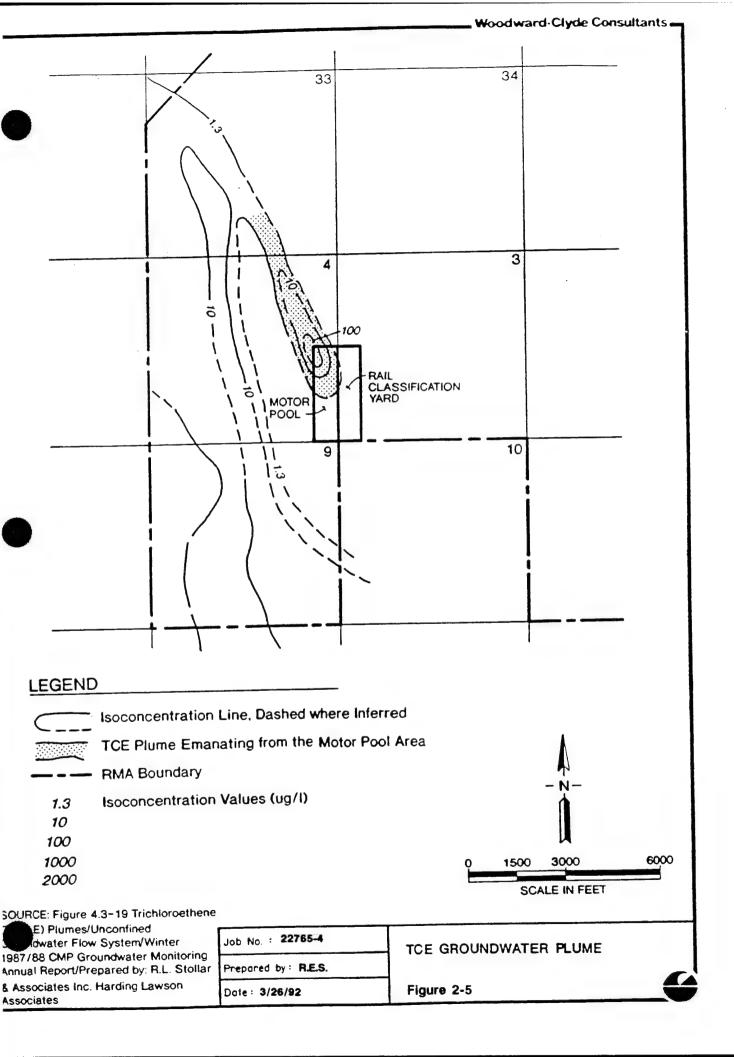
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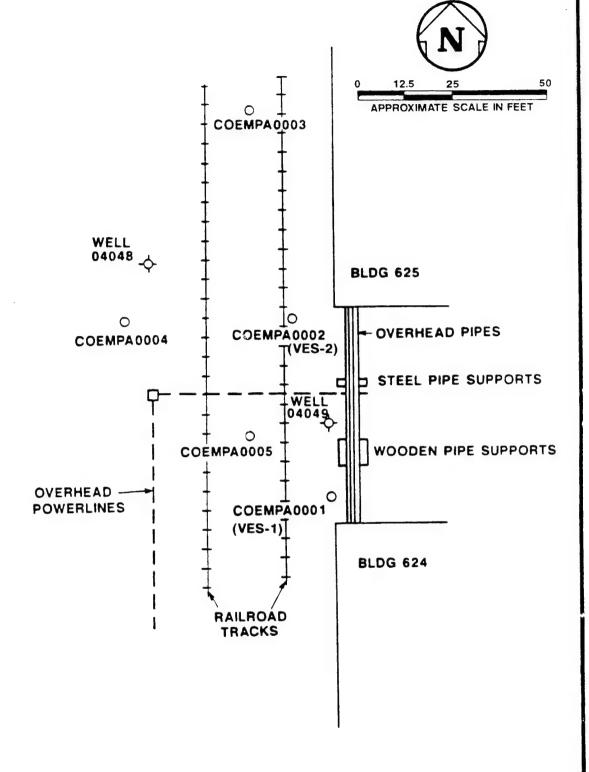












LEGEND

O BORING COEMPA00X

NOTE:

BORING COEMPA0001 AND BORING COEMPA0002 WERE COMPLETED AS SOIL VAPOR EXTRACTION WELLS (VES-1 AND VES-2, RESPECTIVELY)

Date: 10/9/90

Job No.: 89MC114G MOTOR POOL AREA PRE-DESIGN STUDY BORING LOCATIONS
Prepared by: R.A.B.

ROCKY MOUNTAIN ARSENAL, COLORADO

FIGURE 2-6

4

3.0 TECHNICAL APPROACH

This section presents a description of the SVE system used for this pilot study and discusses details of the pilot test operation as well as the data collection and analysis program.

3.1 SYSTEM DESCRIPTION

In situ soil vapor extraction systems provide a method to remove volatile organic compounds (VOCs) from contaminated soil. When operated properly, an SVE system can be one of the most cost-effective remediation processes for soils contaminated with gasoline, solvents, or other volatile compounds. When an SVE system is applicable, partial or complete remediation is possible using simple equipment, with minimal requirements for intrusive procedures such as excavation, and with little or no contaminated materials requiring disposal.

An SVE system, in its simplest form, consists of one or more extraction wells, a separation tank to remove entrained or condensed water, and a vacuum blower to draw vapors containing the volatile contaminants from the soil. Often, the extracted vapors may be discharged directly to the atmosphere. In some cases, because of regulatory requirements or health risks, above-ground treatment of the extracted vapors may be required. Treatment technologies commonly employed include adsorption of the vapor phase organic compounds on granular activated carbon (GAC) or thermal/catalytic treatment of the organic vapors.

3.1.1 Extraction and Monitoring Wells

As shown in Figure 3-1, two soil borings were completed as extraction wells (VES-1 and VES-2) during the 1990 soil sampling event. A one-day study was performed using these wells and a mobile SVE system to gather preliminary data to aid in the design of the pilot system. Based on the air permeability data obtained during this study, extraction wells VES-3 and VES-4 were installed for the pilot test. VES-3 was screened from

approximately 13 to 28 below ground surface (bgs) and was used for testing the shallow extraction zone. VES-4 was screened from approximately 43 to 58 feet bgs for testing a deeper screened interval. The purpose of extracting from both a deep and shallow zone was to assess the optimal screened interval for future vapor extraction wells in the event that the pilot test results indicated that additional vapor extraction wells were appropriate. The SVE system designed for this pilot study can be easily scaled up to accommodate additional extraction wells.

Based on the suspected plume gradient, four clusters of soil gas monitoring wells were installed at the locations shown in Figure 3-1. Each cluster had a well screened in the following locations: a shallow interval, (A), within the range of approximately 12 to 14 feet bgs, to evaluate whether any significant short-circuiting occurred as a result of air being drawn in from the ground surface; an intermediate interval, (B), within the clay layer to evaluate the effect of the SVE system on soil gas within the low permeability lens (30 to 38 feet bgs); and a deep interval, (C), within the range of approximately 52 to 56 feet bgs and near the groundwater table, to evaluate temporal trends of soil gas concentrations near the groundwater. Soil gas monitoring wells P-5, P-6, and P-7 extended radially to the north of the extraction wells, while P-8 was located to the west of the wells to evaluate radial variations.

The soil gas monitoring probes consisted of a 1-foot long, 1-inch-diameter slotted (.02-inch slots) PVC pipe with caps on both ends. During installation, the soil gas monitoring probes were lowered into the 4-inch diameter borings to the previously specified depth. A coarse sand was backfilled around the probes. Each probe was connected to the surface with ¼-inch diameter polyethylene tubing for monitoring the vacuum and TCE concentrations in the soil gas.

3.1.2 Above-Ground Equipment

The shallow and deep extraction wells were connected to the vacuum blower through an insulated PVC pipe installed on the ground surface. The blower and associated equipment were located in a temporary building near the northwest corner of Building 624. A liquid/vapor separator tank was installed between the extraction wells and the blower to allow for collection of any moisture that condensed from the gas stream. The

separation tank was equipped with an automatic vacuum relief valve, a vacuum gauge, a site gauge (to monitor the amount of water in the tank), a drain valve, and a liquid level float-operated switch to shut the system down, should the water level rise past a preset level. (No water was collected during the operation of this pilot unit.) An inline filter was installed prior to the blower to remove any fines or silts which could damage the blower impeller. A regenerative blower driven by a 10-hp electric motor, capable of moving 250 cubic feet per minute (cfm) at 30 inches of water (vacuum) was selected for this pilot system. This belt-driven blower had the capability of operating under a wide range of conditions. To remove TCE from the extracted gas, the exhaust air was discharged to a series of GAC canisters. The first series of vapor phase GAC canisters was capable of removing approximately 90 percent of the TCE from the extracted gas, while the second series of canisters served as polishing units. Refer to Figure 3-2, Process Flow Diagram, for locations of the monitoring instrumentation and sampling ports.

3.2 PILOT TEST OPERATION AND DATA COLLECTION PROGRAM

The Rocky Mountain Arsenal Motor Pool Area pilot test consisted of two sequential phases: short-term operation and long-term operation. Data was collected during these two phases of operation to provide information to meet the following objectives:

- Evaluate the horizontal and vertical soil gas VOC distribution at the Motor Pool Area to attempt to identify the nature or source of TCE.
- Evaluate the effectiveness of soil vapor extraction at the site.
- Evaluate the optimal extraction interval and operating conditions, based on observed pressure distributions, flow rates, and soil gas VOC distributions.

3.2.1 Short-Term Operation

The short-term operation period was conducted during the first four weeks of the pilot test where soil gas was extracted from VES-3 (shallow) for two weeks and then from

VES-4 (deep) for the two remaining weeks. Field sampling and analysis was performed on the first, third, and fifth days of both weeks, and laboratory analysis was performed on the first, third, and fifth days of the first week and in the middle of the second week. This program was repeated during weeks 3 and 4 when soil gas was extracted from the deep interval.

3.2.2 Long-Term Operation

The long-term operation began immediately following the short-term operation period and continued for approximately four additional months. Soil gas was extracted from the shallow interval during the first part of the long-term operation. Soil gas extraction continued at a steady state for approximately two weeks. System operation was then suspended for one week. This cycle was repeated three times while extracting soil gas from the shallow unit. Soil gas was then extracted from the deep interval, and the same cycle (steady state, recovery) was repeated three times.

3.2.3 Data Collection

The data collected from the short-term operation is summarized in Table 3-1, and the data collected from the long-term operation is summarized in Table 3-2. Field data collection included recording of barometric pressure; pressure readings at the extraction well (VES-3 or VES-4), separation tank, before the first GAC unit, between the two GAC units, after the second GAC unit, and at all three depths of each of the four soil gas monitoring wells; temperature readings before and after the GAC units; and flow rate of the extracted gas from the orifice meter. These data were used to evaluate operating parameters for remediation.

Field sampling and analysis was performed using TCE-specific Sensidyne tubes and/or a photoionization detector (HNu) at the following 15 points: gas extracted from either VES-3 or VES-4; gas between the two GAC units; gas after the second GAC unit; at all three depths for each of the four soil gas monitoring wells.

Confirmation sampling and analysis consisted of taking samples and sending the samples to a laboratory for chemical analysis. A modified NIOSH method using a Gilian®

personal sampling pump and charcoal tube samples was used for the confirmation sampling and analysis. Confirmation sampling and analysis was done at the following 14 points: gas extracted from either VES-3 or VES-4; gas after the second GAC unit; at all three depths of each of the four soil gas monitoring wells.

The long-term operation consisted of the six cycles as described above, with three cycles for shallow extraction and three cycles for deep extraction. Each cycle consisted of an initial sampling round followed by approximately two weeks of steady state operation and one week of suspended operation. Field data, field samples, and lab samples were collected at the beginning of each cycle. During steady state operations, field data were collected three times each week, field samples at the beginning and end of the week, and a lab sample was taken from the extraction well at the end of the week. At the end of the third cycle, the initial sampling set was performed at the end of the week of suspended operations, before the program was repeated in the deep interval.

Data were analyzed to evaluate the potential source(s) of the soil gas VOC concentrations, and to identify operating parameters for the SVE system during this program. Vacuum distribution was evaluated to determine flow patterns and chemical analysis was evaluated to estimate system performance. Analytical chemistry results can be found in Appendix B.

TABLE 3-1

SHORT-TERM OPERATION MONITORING PROGRAM MOTOR POOL SVE PILOT TEST

	Field Data Collection	Collection'	Field S	Ficld Sampling & Analysis² (15 Sampling Points)	alysis² ts)	Lab (14	Laboratory Analysis³ (14 Sampling Points)	is³ (s)
Period of Operation	Frequency	No. of Sampling Events	Frequency	No. of Sampling Events	Total Number of Samples	Frequency	No. of Sampling Events	Total Number of Samples ⁴
Short-term Operation - Shallow Extraction (VES-3)								
First Week	Daily	5	First, third, and fifth day	m	45	First, third, and fifth day	3	51
Second Week	Daily	5	First, third, and fifth day	Е	45	Once (mid-week)	-	17
Short-term Operation - Deep Extraction (VES-4)								
Third Weck	Daily	5	First, third, and fifth day	3	45	First, third, and fifth day	3	51
Fourth Week	Daily	5	First, third, and fifth day	ы	45	Once (mid-weck)	1	17
Total				12	180	'	∞	136

Field data collection includes recording of: pressure readings at the extraction well (VES-3 or VES-4), separation tank, before the first GAC unit, between GAC units, after the second GAC unit, and at each of the three intervals (shallow, medium, and deep) of each of the four monitoring wells; temperature readings before and after the GAC units; flow rate of extracted gas from the orifice meter; and field conditions (temperature, weather conditions, barometric pressure).

Field sampling and analysis involves the use of TCE-specific draeger tubes (or equivalent) and/or a photoionization detector at 15 sampling points: the extraction well (VES-3 or VES-4); gas between the GAC units; gas after the second GAC unit; and gas from each of the three intervals (shallow, medium, and deep) of each of the four monitoring wells. Samples from 14 sampling points will be analyzed for VOC concentrations: the extraction well (VES-3 or VES-4); gas after the two GAC units; and gas from each of the three intervals (shallow, medium, and deep) of each of the four monitoring wells.

Total number of samples includes a duplicate, field blank, and trip blank (QA/QC samples) for each sampling event (i.e., total number of samples = no. of sampling events x (14 sampling points + 3 QA/QC samples).

TABLE 3-2

LONG-TERM OPERATION MONITORING PROGRAM MOTOR POOL SVE PILOT TEST

	Field Data C	Data Collection		Field (1	Field Sampling & Analysis ² (15 Sampling Points)	lysis² s)	
Period of Cycle	Frequency	No. of Sampling Events	Frequency (per cycle)	No. of Sampling Events (per cycle)	Frequency (for 3 cycles)	Total Number of Sampling Events (for 3 cycles)	Total No. of Samples
Initial Sample	Once	1	Once	1	1	1	15
Steady State	Three times per week	9	At beginning and end of each week	4	8	12	180
Recovery	Three times per week	n	Once	1	n	8	45
Total for Three Cycles (shallow well)	w well)					16	240
Total for Long-term Operation (shallow and deep well)	(shallow and deep	wcII)				32	480

Sheet 2 of 2

TABLE 3-2 (Concluded)

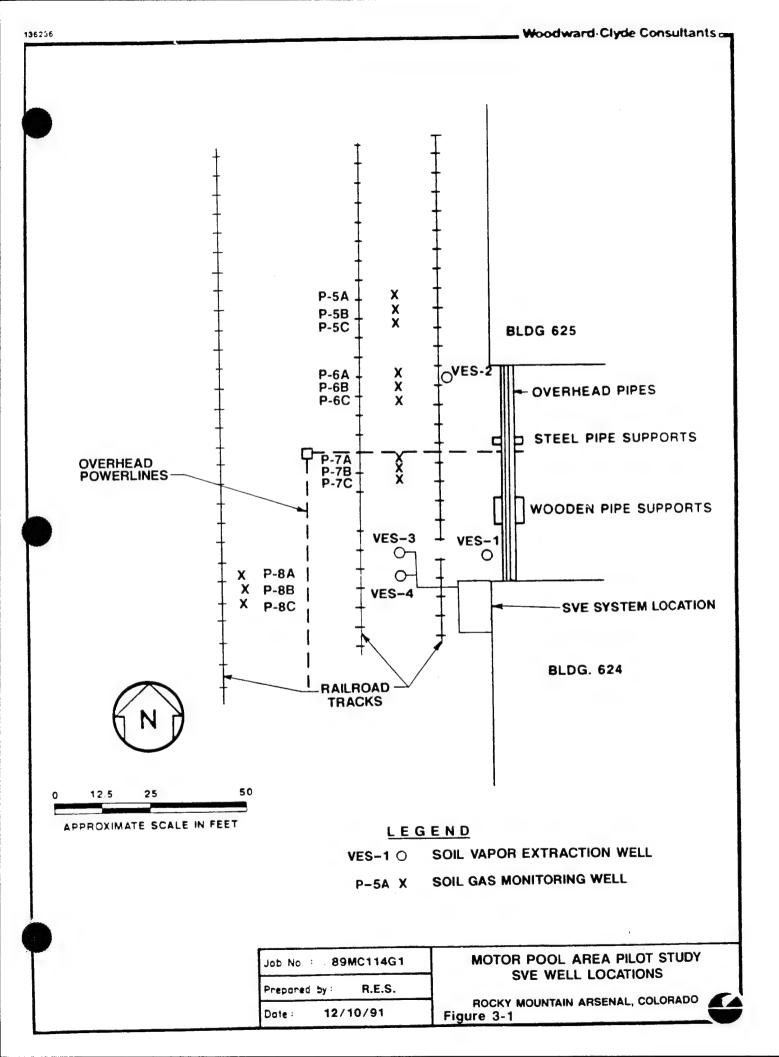
			Laboratory	Laboratory Analysis ³		
Period of Cycle	Frequency (per cycle)	No. of Sampling Events (per cycle)	Frequency (for 3 cycles)	Total No. of Sampling Events (for 3 cycles)	No. of Sampling Total Number Points of Samples ⁴	Total Number of Samples ⁴
Initial Sample	Once	1	1		14	17
Steady State	At end of weck	2	Е	9	_	24
Recovery	Once	-	e	3	. 14	51
Total for Three Cycles (shallow well)	v well)			10		92
Total for Long-Term Operation (shallow and d	a (shallow and deep well)	(1)		20		184

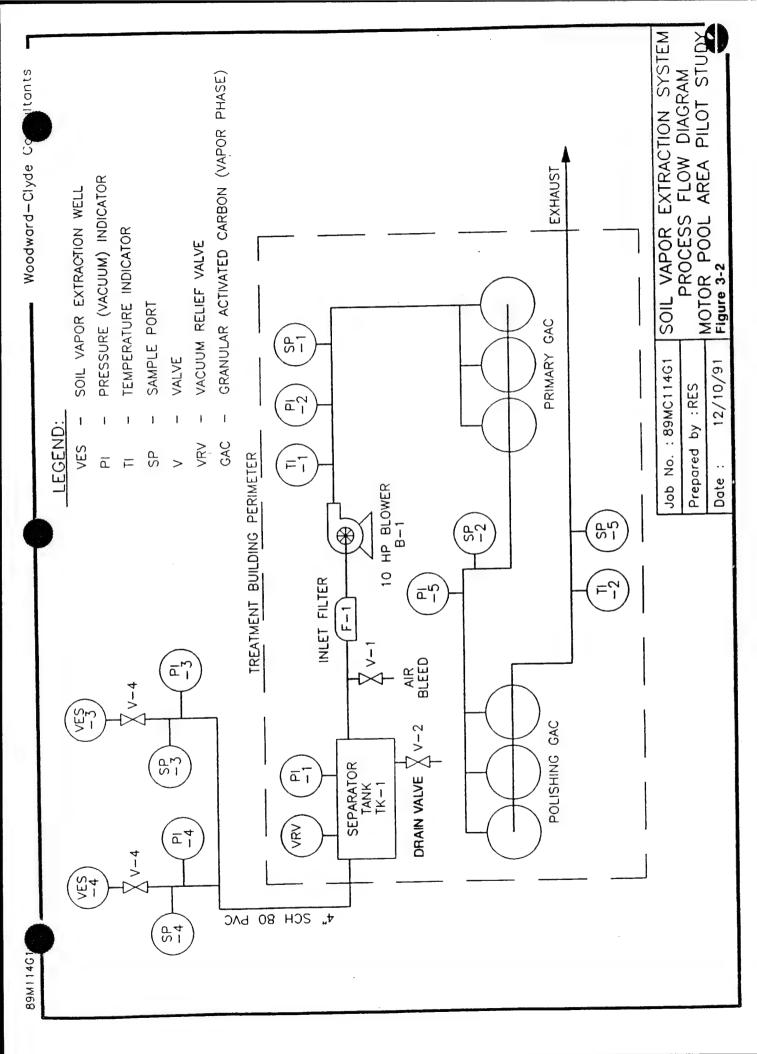
Field data collection includes recording of: pressure readings at the extraction well (VES-3 or VES-4), separation tank, before the first GAC unit, between GAC units, after the second GAC unit, and at each of the three intervals of each of the four monitoring wells; temperature readings before and after the GAC units; flow rate of extracted gas from the orifice meter; and field conditions (temperature, weather conditions, barometric pressure).

extraction well (VES-3 or VES-4); gas between the GAC units; gas after the second GAC unit; and gas from each of the three intervals of each of the Field sampling and analysis involves the use of TCE-specific Draeger tubes (or equivalent) and/or photoionization detector at 15 sampling points: the four monitoring wells.

Samples from 14 sampling points will be analyzed for VOC concentrations: the extraction well (VES-3 or VES-4); gas after the two GAC units; and gas from each of the three intervals of each of the four monitoring wells. When only one sampling point is specified, that point is the extraction well (VES-3 or VES-4).

Total number of samples includes a duplicate, field blank, and trip blank (OA/OC samples) for each sampling event (i.e., total number of samples = total no. of sampling events x (14 sampling points \pm 3 OA/OC samples))





4.0 OBSERVATIONS AND RESULTS

4.1 AIR PERMEABILITY TEST RESULTS

Prior to initiation of the data collection program, the soil permeability to air flow (a measure of the ability of air to pass through a porous media) was estimated to confirm the suitability of soil vapor extraction for this site. To calculate soil permeability, vacuum readings were taken at P-7B (representative of medium depth soil gas monitoring wells) at 5-minute intervals during system start-up. These readings were taken until steady state conditions were observed (approximately 30 minutes). Figure 4-1 shows a plot of vacuum at P-7B vs. the natural log of time when extracting from the shallow extraction well. This figure was used to predict the soil permeability to vapor flow in soils from the ground surface to approximately 38 feet bgs. The slope and Y-intercept of this plot were used in the following equation (Johnson et al., 1990) to predict soil permeability:

$$K = \frac{r^2 \epsilon \mu}{4 P_{atm}} \exp \left(\frac{B}{A} + 0.5772 \right)$$

where:

r = radial distance from vapor extraction well, 22 feet

 ϵ = air-filled soil void fraction, 0.3

 μ = viscosity of air, 1.8 x 10⁻⁴ g/cm-s

K = soil permeability to air flow (Darcys, or cm²)

 P_{atm} = ambient atmospheric pressure, 0.83 atm

B = Y-intercept from plot of pressure vs. natural log of time

A = slope from plot of pressure vs. natural log of time

This equation predicts a soil permeability to air flow of 167 darcys, indicative of silty to clean sand (Freeze and Cherry, 1979). The soil permeability to air flow was also estimated for extraction of soil gas from the deep extraction well (VES-4). Vacuum readings were taken at P-5C (62.5 feet radially from the extraction well) at 5-minute

intervals until steady state conditions were observed. Using Figure 4-2 and the same correlation, soil permeability to air flow was estimated at 2860 darcys. The higher permeability in the deeper region is indicative of clean sand to gravel. The high soil permeability-to-vapor flow, in both the shallow and deep regions, confirmed the suitability of soil vapor extraction to remediate contaminated soils at the RMA MPA.

4.2 SHORT-TERM OPERATION

The short-term operation of the pilot study was completed August 9, 1991. Figure 4-3 shows the TCE concentration in the blower exhaust decreasing from 51.6 mg/l or parts per million (ppm) to 10.6 ppm after the first week of extraction from the shallow well, VES-3. Figure 4-4 shows the TCE concentration in the blower exhaust decreasing from 18.3 ppm to 5.8 ppm during a 10-day period of extraction from the deep well VES-4. Comparing Figures 4-3 and 4-4, it can be seen that the initial TCE concentration detected in the blower exhaust was greater during the shallow well extraction. It may have been that the majority of the remaining TCE in the vadose zone is present above the clay lens. This suggests that the contribution from TCE re-volatilizing from the groundwater is probably minimal.

4.3 LONG-TERM OPERATION

Figures 4-5 and 4-6 show the TCE concentration measured at the blower exhaust during the long-term operation for both the shallow and deep extraction wells. The exhaust concentrations ranged from 2,500 parts per billion (ppb) to 4,300 ppb in the shallow extraction well and 2,400 ppb to 2,800 ppb in the deep extraction well. This was considerably less than observed during the short-term operation, indicating that the majority of TCE contamination had been removed during the initial operation of the pilot study. As expected, the TCE concentration continued to decrease until the system was shut down for the designated recovery period. The TCE exhaust concentration increased slightly when system operation was initiated after the recovery period. For example, in the shallow well, the TCE concentration increased from approximately 2,500 ppb to 3,800 ppb during an initial recovery period. The results of the intermittent flow or pulsing operations suggest that the volatilization of TCE was somewhat limited

by either diffusion of the adsorbed TCE on the soil or the dissolved TCE in the groundwater to the induced air stream.

Table 4-1 presents the overall results of the pilot study for both short and long-term operation including TCE concentrations in the soil gas monitoring wells. The concentration of TCE measured at the blower exhaust during the entire pilot study is shown graphically in Figure 4-7. As seen in this figure, the exhaust concentration decreased rapidly during the short-term operation but remained low and relatively consistent throughout the remainder of the study.

4.4 SYSTEM EFFECTIVENESS

Figures 4-8 and 4-9 represent the vacuum measured at the monitoring wells as a function of their distance from the extraction well. The nearest monitoring wells are P-7 A, B, and C, at a distance of approximately 22 feet. The farthest wells are P-5 A, B, and C, at 62.5 feet. Figure 4-8 represents vacuum decreases with respect to distance, as measured in the shallow soil gas monitoring wells when extracting from the shallow interval. As expected, the vacuum in the shallow soil gas monitoring wells decreased as the distance from the shallow extraction well increased. Appreciable vacuum (0.6 inches of water column) was still being measured 62.5 feet from the extraction well at monitoring well P-5A indicating the lack of a surface seal did not significantly reduce the radial influence of the shallow extraction well. The vacuum at the medium and deep soil gas monitoring wells, although considerably less than in the shallow zone, remained relatively constant, independent of distance from the extraction well. It appears the clay lens prevented the shallow extraction well from effectively influencing the deeper regions.

Figure 4-9 shows the vacuum distribution during deep well extraction. The small and relatively constant vacuum measured in the shallow soil gas monitoring wells (12 to 14 feet bgs) indicates that the clay is apparently providing an effective boundary to soil gas flow. As predicted, the vacuum decreased with distance from the deep extraction well in the medium and deep soil gas monitoring wells.

The concentration of TCE in each of the soil gas monitoring wells had decreased to non-detectable or low levels during the course of the pilot study. Figures 4-10 through 4-13 depict the rapid decrease in soil gas concentrations in the shallow monitoring wells after completion of the short-term operation. In the shallow monitoring wells, intermittent flow operation did not result in an expected rebound in soil gas concentrations in the later recovery periods, indicating that the shallow region had been completely remediated with extraction from the shallow well. Figures 4-14 through 4-17 and Figures 4-18 through 4-21 show TCE concentrations over time in medium and deep regions of the monitoring wells, respectively. As with the shallow region, the TCE concentrations in the medium and deep regions decreased dramatically during the short-term operation. As shown in these figures, the initial recovery phases during the long-term operation did result in corresponding small increases in TCE concentrations as measured in the soil gas monitoring wells. The later recovery phases produced no significant increase in TCE concentrations.

Table 4-2 presents a summary of the typical operating conditions recorded during the SVE pilot study.

Figure 4-22 shows a plot of the total mass TCE extracted over the pilot study, with approximately 67 lbs removed in approximately five months of system operation. Although 1,2-dichloroethene and vinyl chloride were analyzed for during the test, neither analyte was observed in any of the samples.

Sheet 1 of 2

TABLE 4-1

SVE PILOT STUDY SUMMARY OF ANALYTICAL RESULTS

						d.	CE Concenti	TCE Concentrations (ppm)						
Sampling Date	P-5A	P-5B	P-5C	P-6A	P-6B	P-6C	P-7A	P-7B	P-7C	P-8.A	P-8B	P-8C	VES-3	VES-4
STS														
7-16-91	12.9	30.2	34.2	27.8	36.8	34.1	65.4	44.4	36.3	15.5	19.4	4.3		
7-17-91	23.5	6.3	ND	12.2	6.5	ND QN	7.6	10.8	QN	2.1	2.2	6.0	51.6	
7-19-91	5.3	20.0	23.4	6.5	20.1	26.5	QN	24.6	25.7	CN	11.6	11.9	16.7	
7-24-91	1.0	3.1	7.5	3.1	7.3	20.2	S	4.41	8.3	QN	4.2	ND	10.6	
STD														
7-29-91	ND	2.1	ND	Ξ	3.1	2.1	ND	3.1	2.1	ON	3.2	QN		18.3
7-31-91	QN.	0.7	2.8	ON	1.4	QN	QN	QN QN	2.2	Q	2.1	2.2		13.6
8-2-91	ND	QN	0.7	QN	1.4	1.4	N O N	ND	1.4	QN	2.1	QN		9.5
8-7-91	ND	ND	0.7	QN Q	1.4	1.5	QN	Z	1.4	ND	2.9	7.8		5.8
LTS														
8-12-91	ND	ND	2.8	QN	ND	ND	ND	N Q	ON	ND	ND	2.1	3.6	
8-19-91	Z	0.7	NO	Q.	0.7	2.8	SZ	2.1	2.1	ND	7.0	2.1	3.5	
8-26-91	ND	1.1	0.4	QZ	0.7	ND	CIN	0.7	<u>S</u>	ND	0.7	ND	2.7	
8-30-91	S	1.1	QN QN	ND	0.7	0.4	S	Ξ	1.	ND	0.4	0.7	i	
9-3-91	S	6.4	0.7	QN	QN	0.4	S	ON	3.9	QN	0.4	ND	4.3	
16-6-6	Q Q	QN	0.4	QN	S	0.4	N.	S	QN	QN	QN	1.0	2.8	
9-16-91	QN	QN	ND ON	ŝ	ND	GN.	S	Ŝ	QN	QN	QZ	ND	2.5	
9-20-91	S	ND	CZ	Q	QN ON	0.7	S	Q.	1.1	<u>S</u>	0.4	Q N	;	

(Concluded) TABLE 4-1

	VES-4					1	2.6	2.8	2.4	2.7	2.7	1	2.4	2.7	1.7	2.8
	VES-3	3.6	2.8	3.2												
	P-8C	1.0	QN	1.6		1.9	2.1	ON.	ND	ÖZ	ND	ND	QN	1.4	0.4	0.4
	P-8B	0.3	0.5	0.5		ND	0.4	QN	0.4	ND	ND	QX	ND	0.2	0.4	QN
	P-8A	Z	QN	ND		ND	ND	QN	ND	QN	ND	CN	ND	ND	ND	QN
	P-7C	QN	1.6	2.3		2.0	ND	S	ND	QN	QN	QN	QN	1.1	9.0	0.2
rations (ppn	P-7B	QN	1:1	0.7		0.4	ND	ON	ND	GN .	Z	ND	ND	ND	QN	ND
TCE Concentrations (ppm)	P-7.A	ON	NO.	S		ND	ND Q	ND	Q.	CN	Z	ND	ND	ND	N	QN
	P-6C	2.0	1.4	2.1		1.2	N Q	ND	QN	ND	Q	ND	QN.	NO	ND	QN
	P-6B	ON	0.7	6:0		0.7	0.4	ON	NO	S	S	S	QN	ND	N	ON
	P-6A	ND	QN.	ND Q		Q	QN.	ON	ND	CN	QN	S	QN	N O N	ND	GN
	P-5C	0.7	1.2	0.4		1.6	0.7	0.5	ND	ON	QN CN	QN	GN	QN	QN	QN
	P-5B	0.7	0.5	0.7		0.5	0.3	QN	QN	QN	ND	ND	QN.	QN	QN	QN
	P-5A	QN	Q Z	ND		S	N	QN	N	QN	QN	Q	QZ	ND	QN	QN
	Sampling Date	9-23-91	10-1-01	10-7-01	CTD	10-11-01	10-12-91	10-21-91	10-28-91	11-1-91	11-4-91	11-11-91	11-18-91	12-2-91	12-9-91	12-16-91

Sample not taken (recovery phase) Non Detect

ND STS STD LTS LTS

Short-term, shallow well (VES-3) extraction

Short-term, deep well (VES-4) extraction Long-term, shallow well (VES-4) extraction Long-term, deep well (VES-4) extraction

TABLE 4-2

SVE PILOT STUDY
SUMMARY OF TYPICAL OPERATING CONDITIONS

Well	Vacuum (in. H ₂ O)
VES-3	0 - 13.8
VES-4	0 - 30
P-5A	0 - 0.74
P-5B	0 - 0.50
P-5C	0 - 0.50
P-6A	0.10 - 1.2
P-6B	0.4 - 1.55
P-6C	0 - 2.05
P-7A	0.32 - 1.80
P-7B	0.30 - 3.0
P-7C	0.30 - 3.05
P-8A	0 - 1.85
P-8B	0 - 2.10
P-8C	0 - 2.30

Separator Tank Vacuum (PI-1):

18.2 - 36.5 in H₂O

Separator Level Gauge:

0 inches

Blower Exhaust Temperature (TI-1):

123 - 153°F

Blower Exhaust Pressure (PI-2):

8 - 12 in H₂O

Blower Exhaust (SP-1):

• HNU:

0 - 20 ppm

Sensidyne:

0 - 15 ppm

Velocity:

2,600 - 6,000 ft/min.

• Flow Rate:

145 - 335 cfm

GAC Exhaust Temp (TI-2):

85 - 138°F

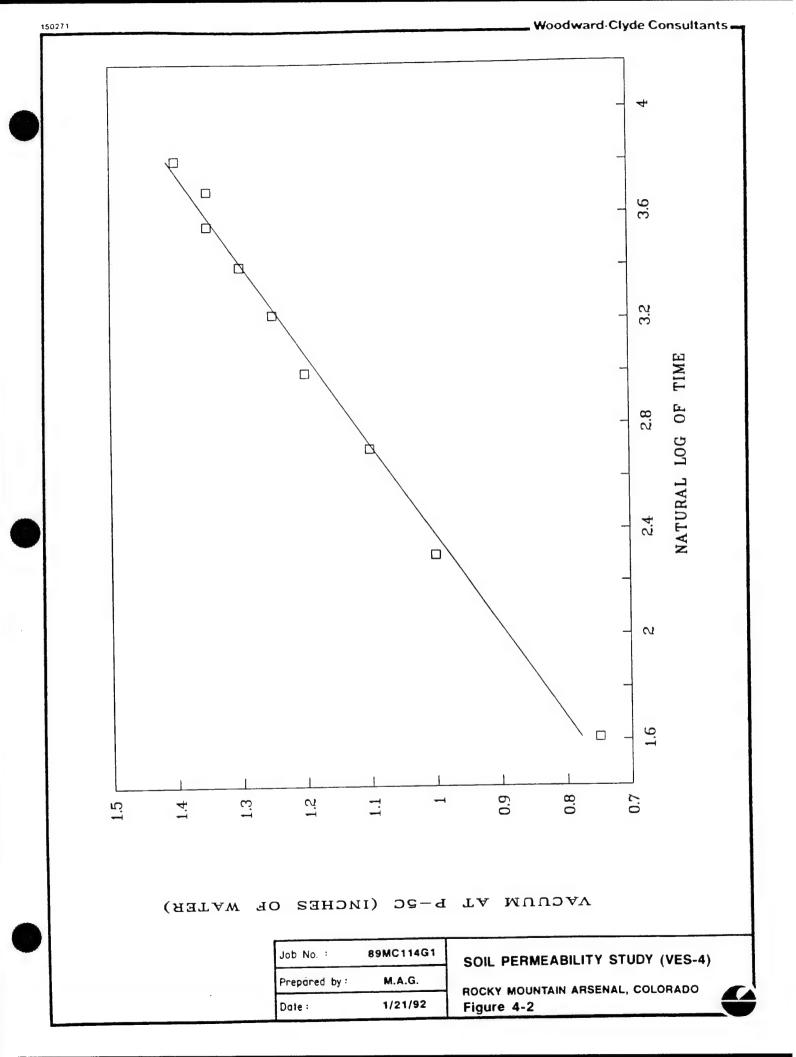
GAC Exhaust Concentration (SP-5) (13.7 lbs/day state emission limit):

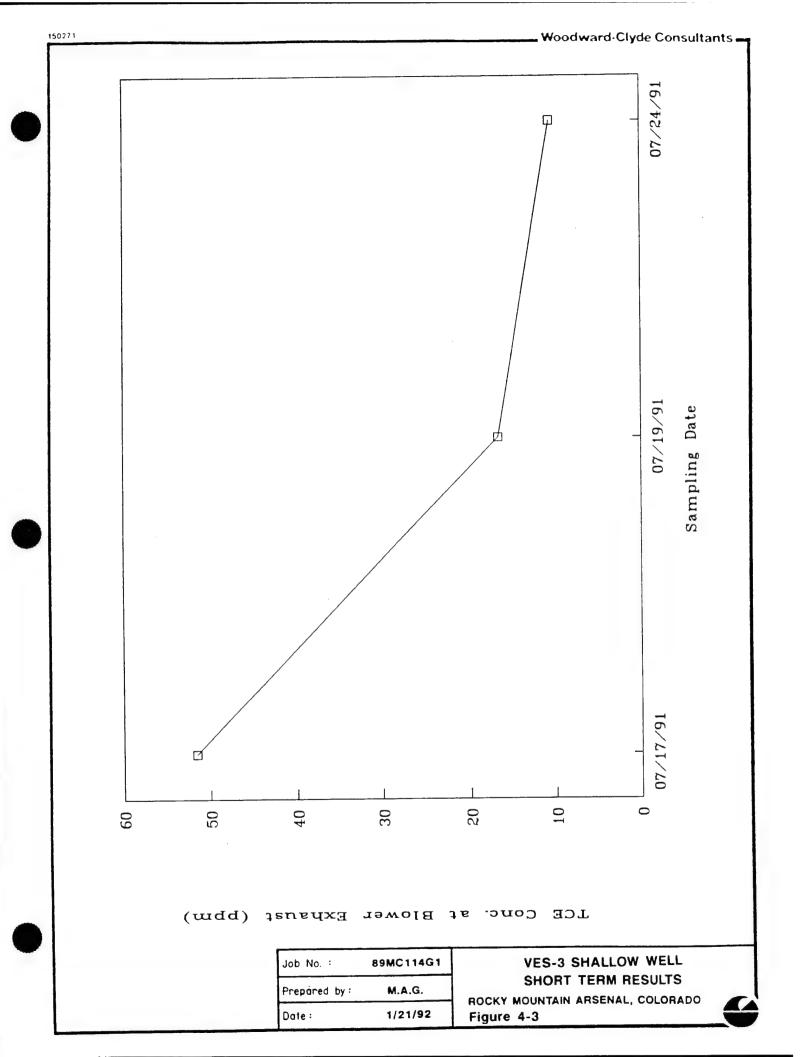
• HNU:

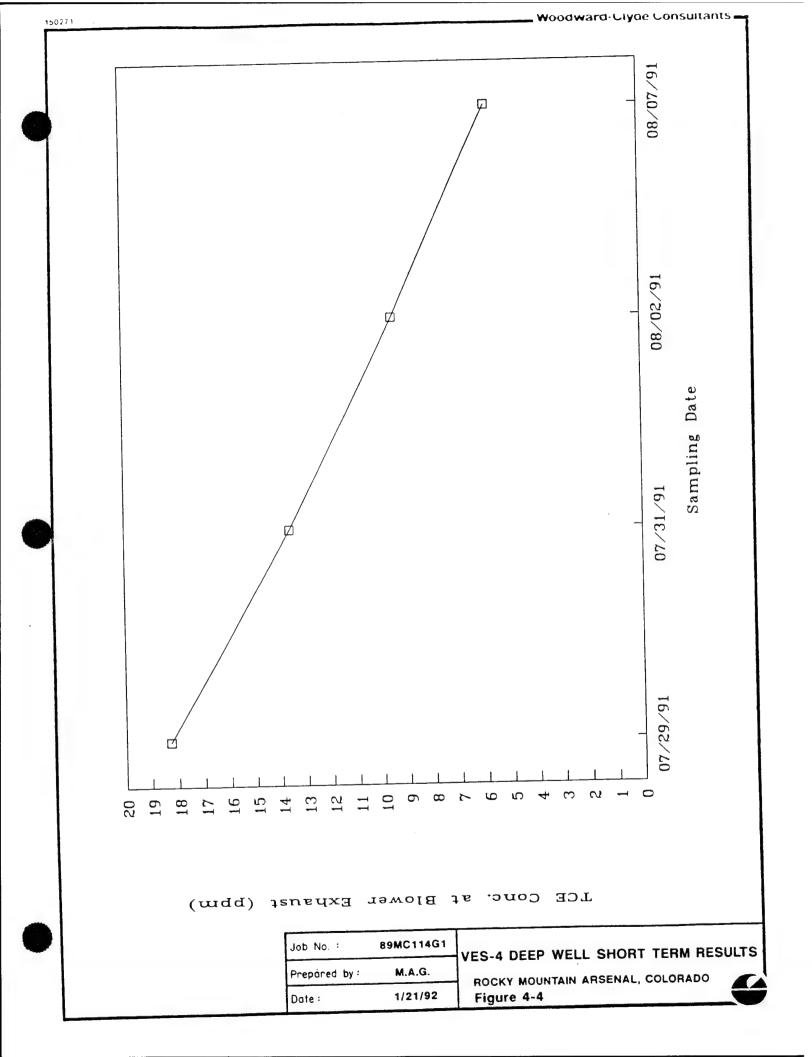
0 - 3.7 ppm

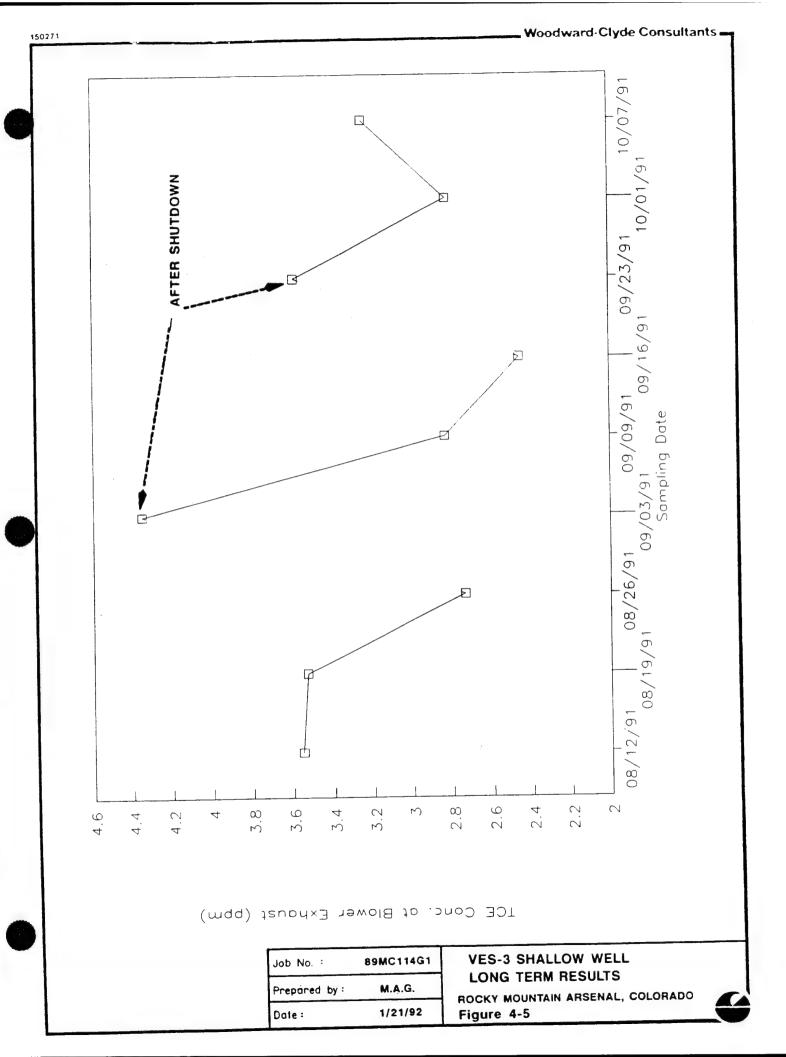
Sensidyne:

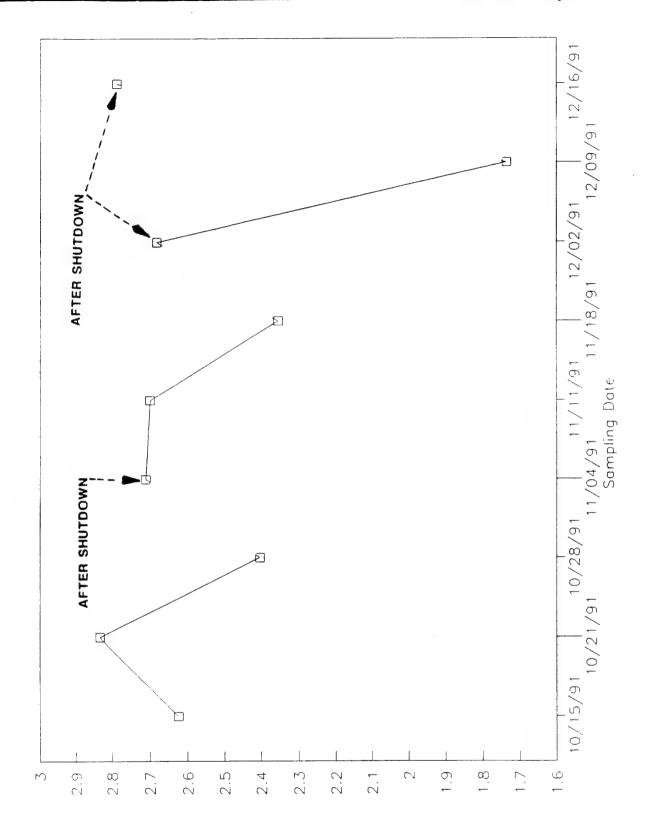
0 ppm









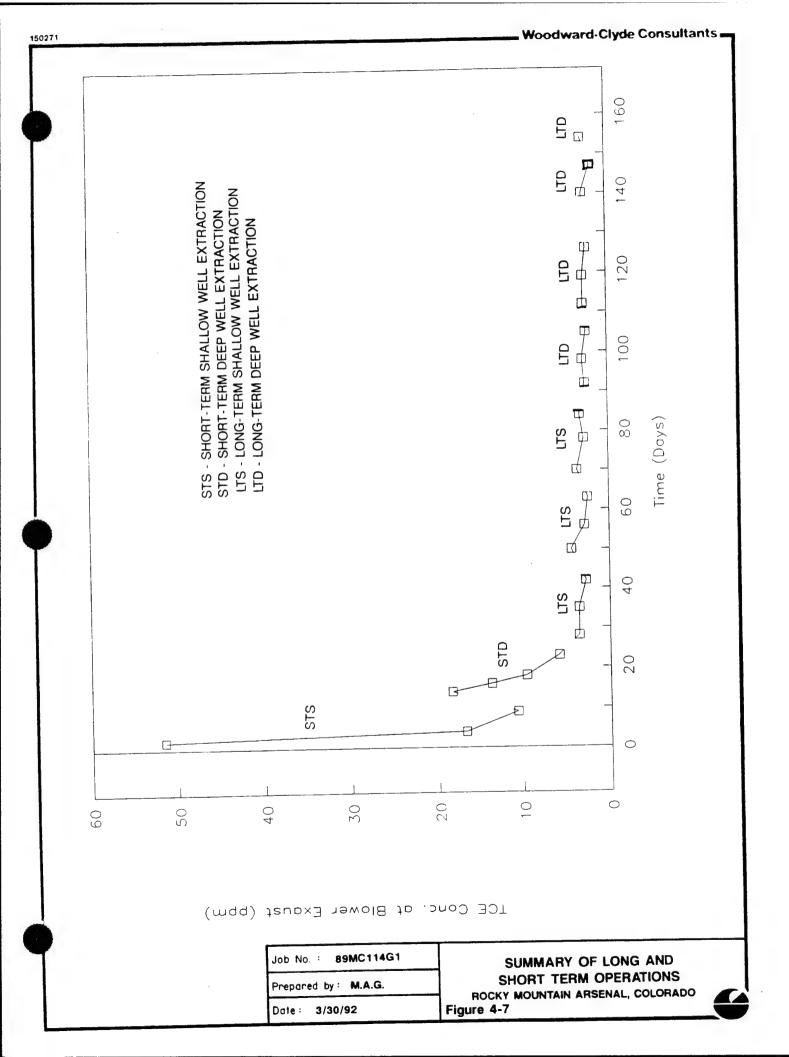


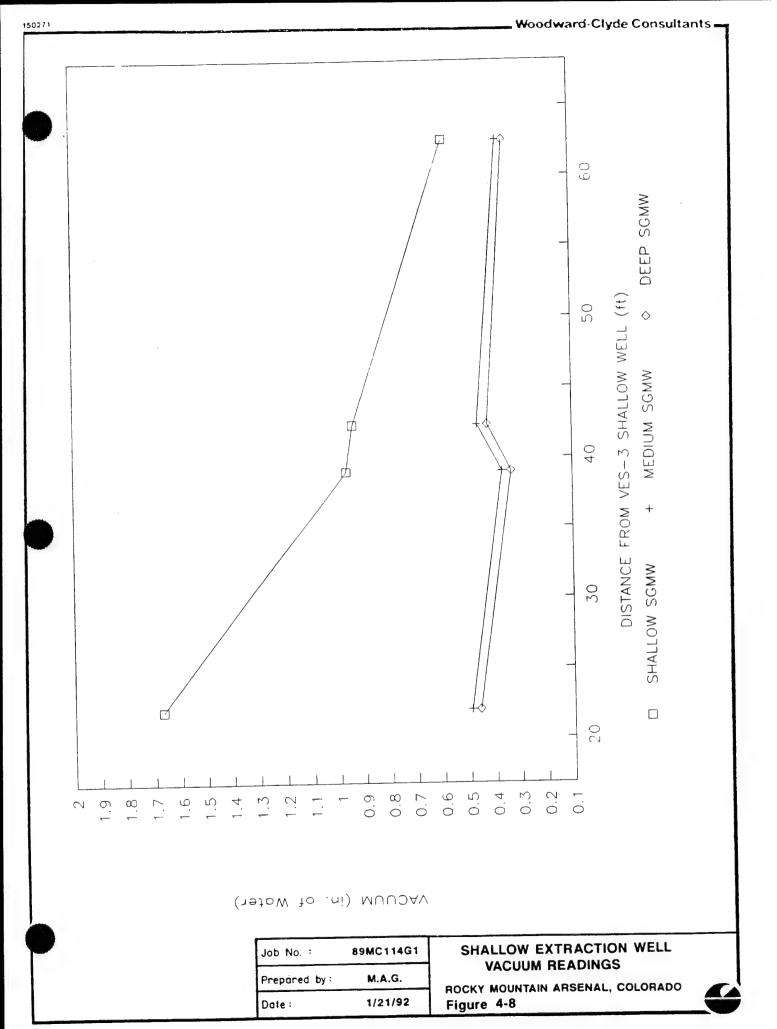
TCE Conc. at Blower Exaust (ppm)

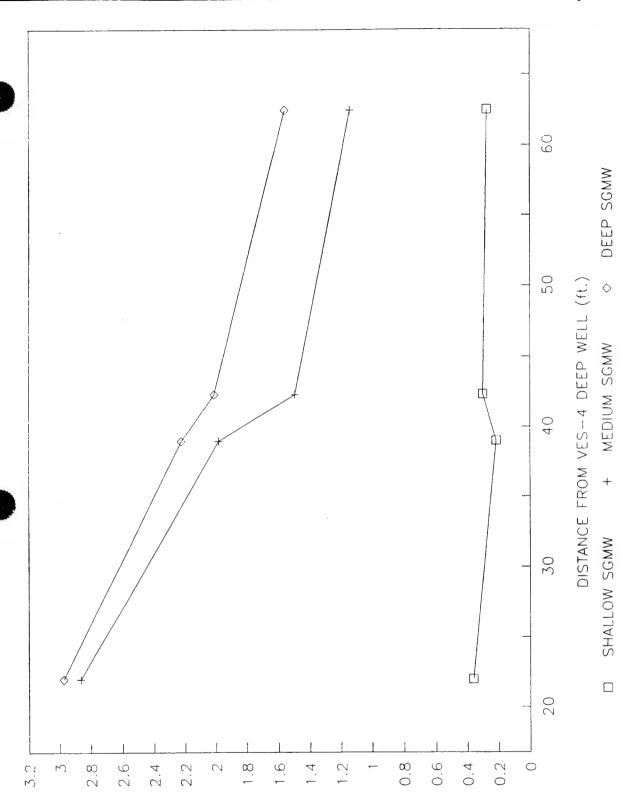
Job No. :	89MC114G1	l,
Prepared by:	M.A.G.	
Data:	1/21/92	1

VES-4 DEEP WELL LONG TERM RESULTS







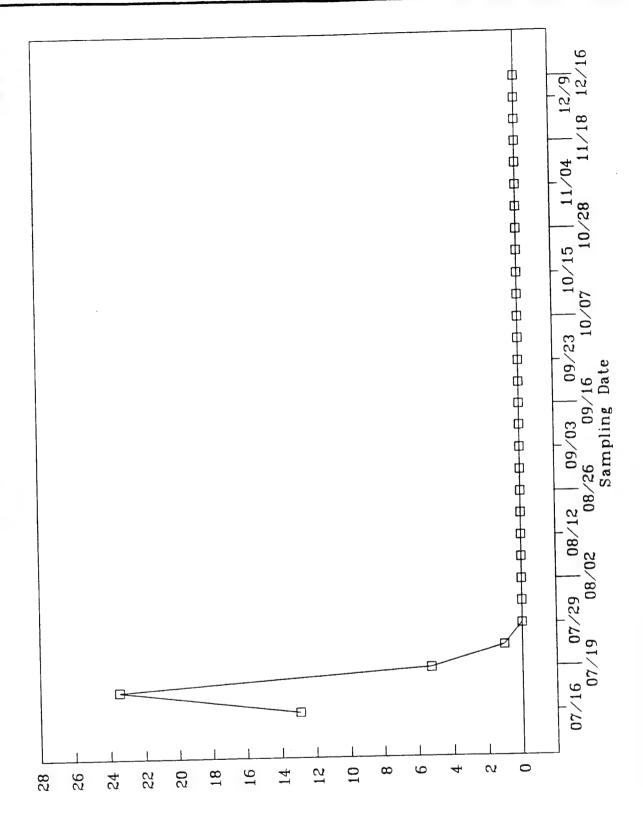


VACUUM (in. of Water)

Job No. :	89MC114G1
Prepáred by:	M.A.G.
Date :	1/21/92

DEEP EXTRACTION WELL
VACUUM READINGS





TCE Conc. at Monitoring Well (ppm)

Job No. :	89MC114G1
Prepared by:	M.A.G.
Date :	1/21/92

P-5A SHALLOW MONITORING WELL



TCE Conc. At Montoring Well (ppm)

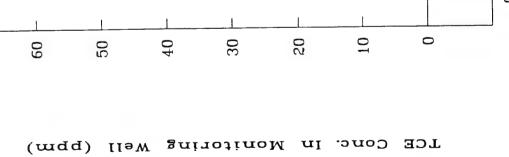
 Job No. :
 89MC114G1

 Prepared by :
 M.A.G.

 Date :
 1/21/92

P-6A SHALLOW MONITORING WELL





Job No. :	89MC114G1
Prepared by:	M.A.G.
Date :	1/21/92

70

P-7A SHALLOW MONITORING WELL



M.A.G.

1/21/92

ROCKY MOUNTAIN ARSENAL, COLORADO

Figure 4-13

Prepared by:

Date:

M.A.G.

1/21/92

ROCKY MOUNTAIN ARSENAL, COLORADO

Figure 4-14

Prepared by:

Date:

Job No. :	89MC114G1
Prepáred by:	M.A.G.
Date :	1/21/92

P-6B MEDIUM MONITORING WELL

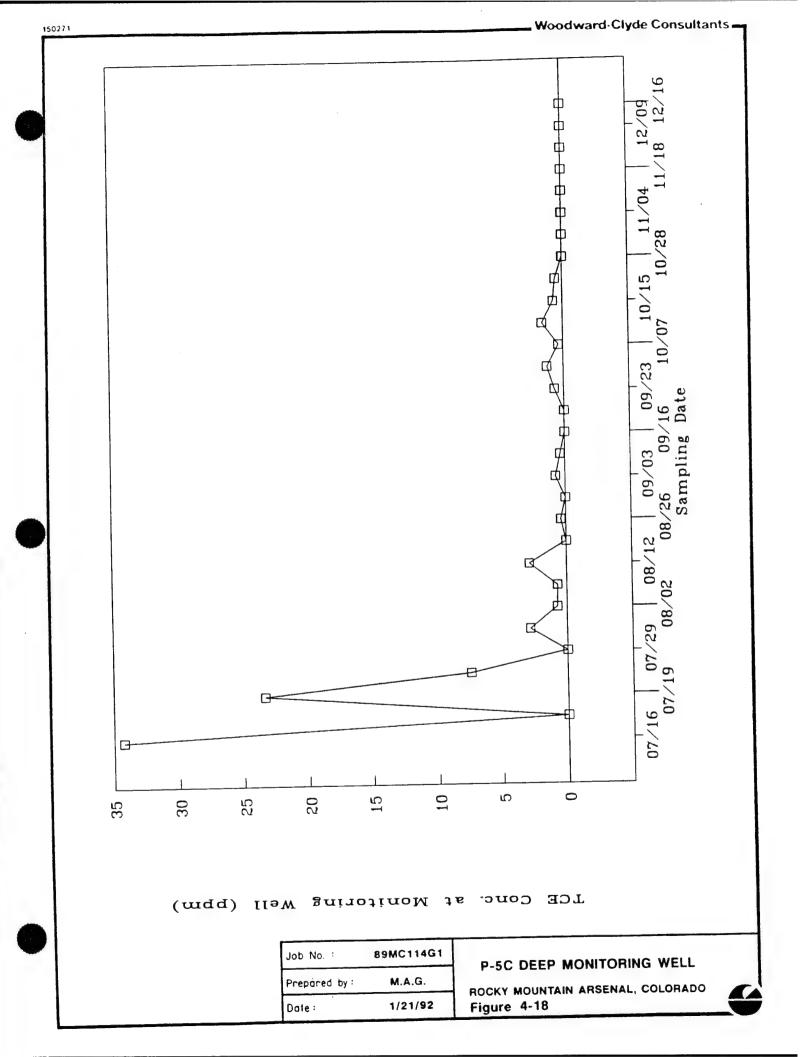


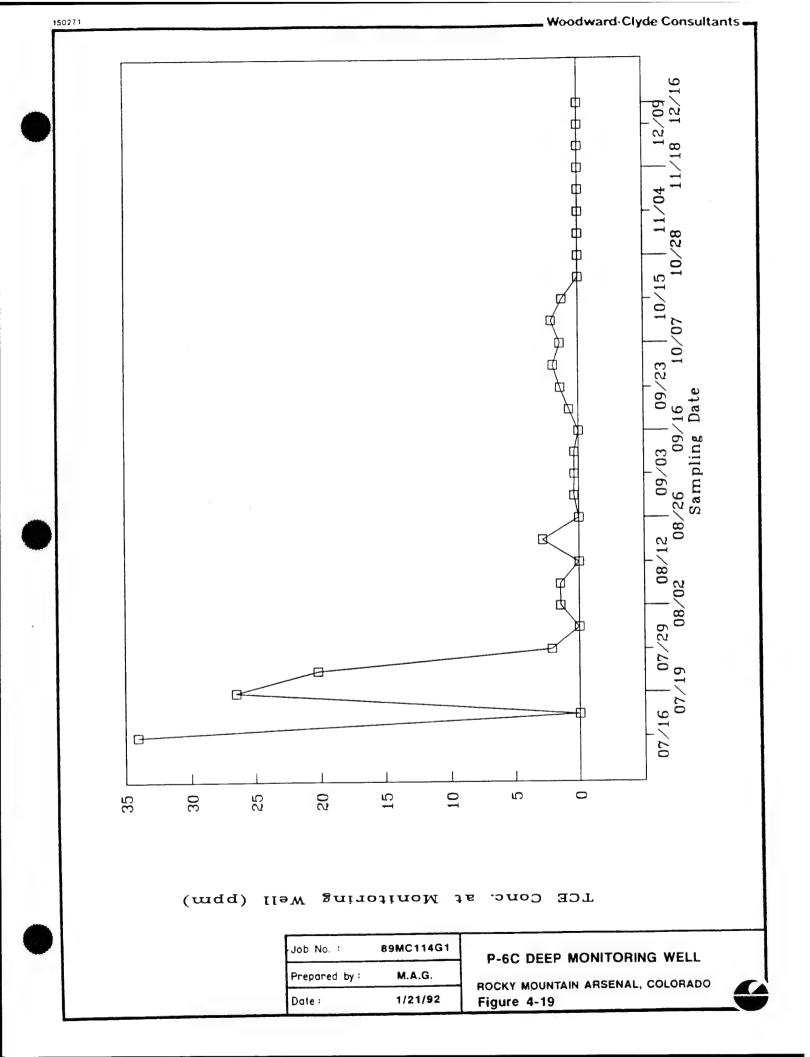
TCE Conc. In Monitoring Well (ppm)

Job No. :	89MC114G1
Prepared by:	M.A.G.
Date :	1/21/92

P-8B MEDIUM MONITORING WELL



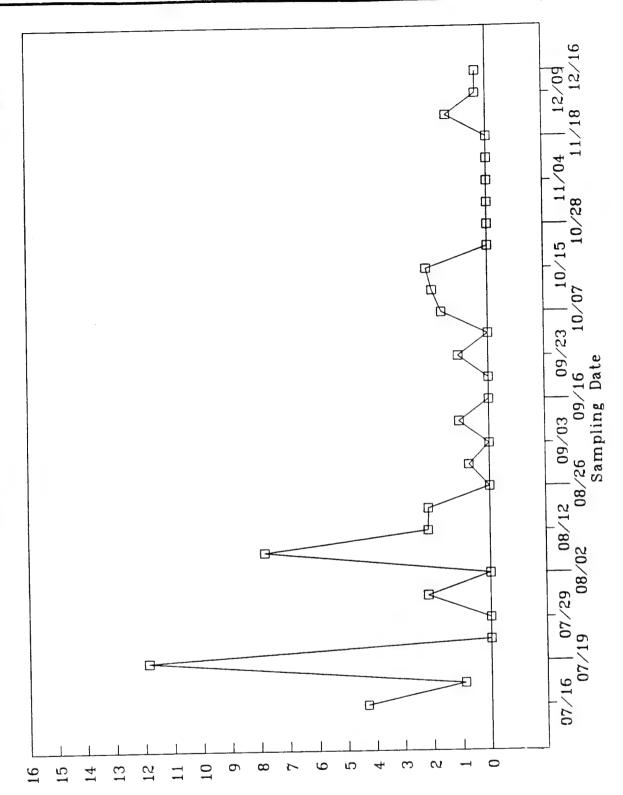




1/21/92

Figure 4-20

Date:

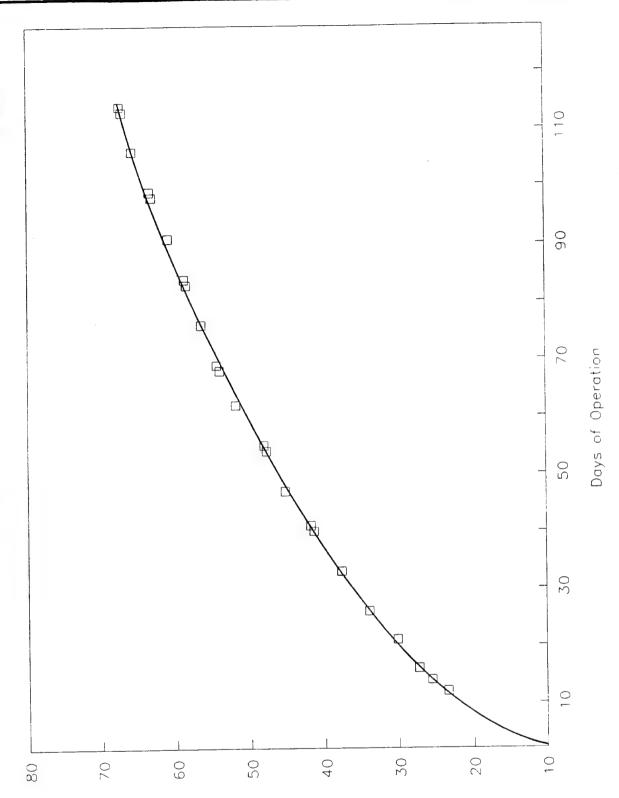


TCE Conc. In Monitoring Well (ppm)

Job No. :	89MC114G1
Prepared by:	M.A.G.
Date :	1/21/92

P-8C DEEP MONITORING WELL





Contaminated Products Extracted (Ibs.)

Job No. :	89MC114G1
Prepared by:	M.A.G.
Date :	1/21/92

TOTAL MASS TCE EXTRACTED



5.0 CONCLUSIONS

Based on the pilot study testing conducted at the Rocky Mountain Arsenal Motor Pool Area, the following can be concluded:

- SVE was an effective remediation technique for removing TCE from the permeable soils found at this site.
- The majority of the TCE contamination was extracted from the shallow and medium regions, which suggests that the clay lens served as a partial vapor barrier to downward migration of TCE. Lower concentrations extracted from the deeper region suggest that re-volatilization of TCE from the groundwater was not a major contribution to the overall mass of TCE removed. It can be concluded the optimum extraction interval was the shallow well.
- Initial observed concentrations of TCE in the soil gas monitoring wells did not exhibit appreciable spacial variations. No conclusions were drawn with respect to horizontal distribution of TCE and potential source areas.
- Based on the vacuum induced in the remote soil gas monitoring probes when extracting from the shallow well, short-circuiting of atmospheric air was not significant, thereby precluding the need for a surface seal.
- TCE concentrations in the soil gas monitoring wells and blower exhaust decreased to non-detectable or low levels over the duration of this pilot study. It can be concluded that soil within the radial influence of the extraction wells (suspected source area) was remediated of TCE and no further extraction is required.

6.0 REFERENCES

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- Woodward-Clyde Consultants. February 1990. Final Decision Document for the Interim Response Action at the Motor Pool Area Rocky Mountain Arsenal, Version 4.0. RIC 900072R04.
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APPENDIX A WELL CONSTRUCTION DETAILS

GROUNDWATER MONITORING WELL AND PIEZOMETER REPORT

PROJECT RMACOE MOTOR POOL VES 89M114G1 LOCATION Section 4 (9948 WCFS) Date Completed 6/6/9/ Original Depth 30' Inspected By H. MERRELL Date Checked By Date	Page of _/ Well No. VES - 3 Aquifer
Ground Elevation Ground Elevation Ground Elevation Ground Elevation Ground Elevation Ground Elevation Ground Elevation Ground Elevation Ground Elevation Ground Elevation of top of surface casing pipe above ground surface. Depth of surface seal below g surface Type of surface casing. Type of surface casing below G. D. of riser pipe. Type of backfill: GROUT Elev./depth top of seal. Type of sand pack. Type of sand pack. Type of sand pack. Elev./depth bottom of seal. Type of screened section: Scott Describe openings. Describe openings. Elev./depth bottom of screened Elev./depth bottom of screened	round 2' ground 4" 2 40 10/2" 30' 11(CQ //' 140 PVC ACTORY 1" 28'

GROUNDWATER MONITORING WELL AND PIEZOMETER REPORT

Ground Elevation Ground Elevation Elevation of top of surface easing/ riser pipe. Height of top of surface cosine/riser pipe above ground surface. 20"	PROJECT RMACOE MOTOR POOL V LOCATION Section 4 Date Completed 6/7/9/ Original Inspected By H. MERRELL Checked By	(9948 WCFS) Depin 60'	Page of _/ Well No. VES - 4 Aquifer
Depth of surface casing. Type of surface casing below ground Depth of surface casing. Depth of surface casing below ground Depth of surface casing. Depth of surface casing below ground Depth of borehole Depth of bor	Generalized Stratigraphy and Water Level Star Dack St	deight of top of surface cosine lipe above ground surface. Depth of surface seal below gurface type of surface casing. Depth of surface casing. Depth of surface casing below D. of riser pipe. Type of riser pipe: Depth of borehole Type of backfill: Depth of borehole Type of seal: Depth of sond pack. Depth of top of seal. Type of sand pack. Depth of top of sand pack. Depth of top of sand pack. Depth of top of sand pack. Depth of screened section: Depth of screened section: Depth of screened section: Depth of screened section. Depth of screened section. Depth of screened section. Depth of screened section. Depth of screened section.	round 2 ETE

	OBSERVATION WELL RE	PORT
DOJECT RMACOE MOTOR POC LOCATION SECTION 4 Date Completed 6/11/91 Orig Inspected By H. MERRELL Checked By	inal Depth 15' Well No.	1 of 1 VESP-5A November 12'-/3'
Ground Elevation	Depth of surface seal below ground surface Type of surface seal: Concrete 1.D. of surface casing. Type of surface casing. Type of surface casing. Type of surface casing below ground 1.D. of pipe. Type of riser pipe: 1" Schil 40 PVC Diameter of borehole Type of backfill: BENTONITE CHIPS Elev./depth top of seal. Type of sand pack. Elev./depth top of screened section. Type of screened section: 1" PUC Shil 40 Describe openings. D2D" Factor S/bk 1.D. of screened section. Elev./depth bottom of screened section.	12'

OBSERVATION WELL REPORT

OJECT RMACOE MOTOR POOL VES LOCATION SECTION 4	89M114G1 (9948 WEFS)	Page of Well No. <u>VESP-5B</u>
Date Completed 6/10/91 Original Depth	39'	
Inspected By H. MERRELL Date Checked By 6/10/91 Date		SCREEN 37'-36'

Ground Elevation	ISH MOUNT PROTECTIVE COVER	,
Elevation Fr	Depth of surface seal below ground	2'
the state of the s	Type of surface seal: <u>CONCRETE</u>	
4		
	1.D. of surface casing.	
	Type of surface casing:	
1	191.	1 FT
911-	Depth of surface casing below ground	
	1. D. of pipe. I'm CLIAD PUT	1" Q.D.
	1. D. of pipe. 1" Schel 40 PUC Type of riser pipe: 1" Schel 40 PUC	
-1	Diameter of borehole	_8"
Voier Leve	BEUTONITE to 2'	
15 8 8	Type of backfill: Grout to 15'	
		29'
29	Elev./depth top of seol. Type of seal: <u>BENTONITE CHIPS</u>	
	The decay bottom of section	34'
	Type of sond pock. 20-40 Silka Saus	34'
Iraligraphy (5)	Depth of top of sand pack.	
	Elev. / depth top of screened section.	36'
	Type of screened section: 1" PUC Said 40 Describe openings-020" Factor Slots	
	Describe openings	14 = 2
	I.D. of screened section.	1" O.D.
		37'
	Elev./depth bottom of screened section.\	
		39'
	Elev./depth bottom of sand column.	
1::::1		
1.5:1		39'
	Elev./depth of hole	

		OBSERVATION WELL F	(EPOR I
1	Checked By MOJECT RMACOE MOTOR FOR SECTION 4- Original Completed Original Complete Original	(9948 WCFS) Well ginal Depth 55	No. VESP-5C SEEN 52-53
EI	Flesh Mount > Photective Cap B" diam 12° long 13'	Depth of surface seal below ground surface Type of surface casing. Type of surface casing. Type of surface casing: 1.D. of surface casing below ground 1.D. of surface casing below ground	
Stratigraphy and Water Level	Growt	Diameter of borehole **RENTONITE 13'-2** Type of backfill: GROUT 4412-13 Elev./depth top of seal. Type of seal: BENTONITE CHIPS Elev./depth bottom of seal. Type of sand pack. 20-40 Silica Sal Depth of top of sand pack. Elev./depth top of screened section. Type of screened section: I'' PUC Sau Describe openings-020" Factor Stot	441/2 50 50 50 52 40
Generalized		1.D. of screened section. Elev./depth bottom of screened section.	- 1" O.D. - 53
		Elev./depth bottom of sand column. Elev./depth of hole.	

	OBCENTION	
PROJECT RMACOE MOTOR I LOCATION SECTION 4- Date Completed 6/13/91 Of Inspected By H. MERRELL Checked By	riginal Depth	Page _ of _ Well No. VESP-GA SCREEN Depth Interval 13-14'
Ground Elevation SININININI B"x/2" Z7 Locking Flush Mount. Protective Coner	Depth of surface seal below a surface Type of surface seal: Concumulation 1.D. of surface casing. Type of surface casing. Type of surface casing. 1/4" NYLON TUBINCY	rete 2'. SHEET 8"
Level	Depth of surface cosing below PROTECTIVE 1. D. of pipe. Type of riser pipe: 1" Schole Diameter of borehole	(* OD
Stratigraphy and Water	Type of backfill: (BENTONITE) Elev./depth top of seal. Type of seal: BENTONITE C Elev./depth bottom of seal. Type of sand pack. 20-40 Si Depth of top of sand pack. Elev./depth top of screened section Type of screened section: I" P Describe openings-020" Facto	11(a Save 11'
	1.D. of screened section. Elev./depth bottom of screened s	/" O.D.
	 Elev. / depth bottom of sand colur Elev. / depth of hole. 	nn

	0000	
Dose Completed 6/13/91 Or Inspected By H. MERRELL Checked By	(9948 WCFS) iginal Depth	Page _ 1 of 1 well No. VESP-6B SCREEN 42-43' Depth Interval 42-43'
Ground Elevation B" x / 2" Locking Flush Mount. Photective Cover Elevation Elev	Depth of surface seal below graviface Type of surface casing. Type of surface casing. Type of surface casing. Type of surface casing GALU. 1.D. of surface casing below graviface cosing below graviface cosing below graviface cosing below graviface. Depth of surface cosing below graviface cosing below graviface. I.D. of graviface cosing below graviface cosing below graviface. I.D. of graviface cosing below graviface. I.D. of seriface cosing below graviface. I.D. of screened section. I.D. of screened section.	SHEET 8" SHEET 8" FOUND 15T 10D. PUC 8" 24/PS 4D 40 40 5/oks 1" O.D. 1ion.\ 43

SCEDUATION WELL REPORT

	OBSERVATION WEL	LREPORT
DUECT RMACOE MOTOR POLICE SECTION 4 Date Completed 6/12/91 Original Inspected By H. MERRELL Checked By	jinal Depth	Page o1 _ Well No. VESP-6C SCREEN Depth Interval 55-56
Elevation B" x / 2" Locking Flush Mount. Protective Cover	Depth of surface seal below graviface Type of surface seal: Concre I.D. of surface casing. Type of surface casing: GALU. 1/4" NYLON TUBINCT Depth of surface cosing below graviface cosing below graviface cosing below graviface. I.D. of surface cosing below graviface. Depth of surface cosing below graviface. Type of riser pipe. Type of riser pipe: 1" Scholate Diameter of borehole Type of backfill: Elev./depth top of seal. Type of seal: BENTONITE Craviface. Elev./depth bottom of seal. Type of sond pack. Elev./depth top of screened section. Type of screened section: 1" Puchasing processing processing below graviface. I.D. of screened section. Elev./depth bottom of screened section.	SHEET 8" SHEET 8" round 1ft 1" QD. 8" 8" 8" 8" 8" 8" 8" 8" 1" QD. 53 55' 544 1" QD. 51ion.\ 56'

P	ROJECT RMACOE MOTOR POOL VES 89M 114-G1	Page
1 .	SECTION 4 (9348 WCF3)	Well No. VESP-7A
2	ote Completed 6/12/91 Original Depth 15	
	spected By H. MERRELL Dote.	
In	*	SCREEN 13-14' Depth Interval 13-14'
С	necked By Date	Depin microsc
Ele	Depth of surface seal below grant for surface seal: B" x/2" Locking Aush Mount Protective Cover I.D. of surface casing. Type of surface casing: 1/4" NYLON TUBINCT PROTECTIVE I.D. of riser pipe: I.D. of riser pipe: Diameter of borehole	SHEET 8"
ed Stratigraphy and Water L	Type of backfill: Elev./depth top of seal. Type of seal: BENTONITE C Elev./depth bottom of seal. Type of sond pack. 20-40 Si Depth of top of sand pack. Elev./depth top of screened section Type of screened section: I'' Pu Describe openings.020" Factor	10 10 10 10 10 10 10
Generaliz	Elev./depth bottom of screened section. Elev./depth bottom of screened section.	15
	Elev./depth of hele.	15

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LOCATION SECTION	791 Original Depth 48 RRELL Date	Page _ 1 of 1 Well No. VESP-78 SCREEN Depth Interval 45-46
Ground Elevation B"x/2" Locking Aush Mounts Brotective Cover 2 Chort Cover 3 Chort Cover 4 Chort Cover 4 Chort Cover 5 Chort Cover 6 Chort Cover 7 Chort Cover 7	, pe or 200	SHEET 8" SHEET 8" Ground 1ft 1" OD. 10 PUC 8" 3-2' 3' 38 CHIPS 43 LICA SAND 43 On. 43 ON. 5/64 1" O.D. ection.\ 48

1	Date Completed 6/11/91 Original Depth 58	e _ o1 _ 1 No. <u>VES P - 7C</u> REEN 56-55
_	Depth of surface seal below ground surface Type of surface casing. GALU. SHE Notestive Cover L. D. of surface casing. GALU. SHE NA NYLON TUBINCE I. D. of surface cosing below ground. Type of riser pipe: 1" Schol 40 PV. Diameter of borehole Elev./depth top of seal. Type of sand pack. Depth of top of sand pack. Elev./depth top of screened section. Type of screened section. Elev./depth bottom of screened section.	1 ft 1° 0D. 8" 48 53 53 555 40 40 40 57
	Elev./depth of hole.	_58

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DOLLO COMPLETED BY H. MERRELL	not Depth	Page of Well No. <u>VESP-8A</u> SCREEN Depth Interval _/3'-/4'
Checked By	_ Dote	Depth Interval 13-17
	Depth of surface seal below grantace Type of surface seals: Concr. 1.D. of surface casing. Type of surface cosing: GALU. 1/4" NYLON TUBINCY	ound 2' ete 8"
	Depth of surface cosing below of PROTECTIVE 1. D. of pipe. Type of riser pipe: 1" Schel 41	1" Q.D.
\$ 1 1/1 B YX •	Type of backfill: BENTOUITE Elev./depth top of seal. Type of seal: BENTONITE C.	. 4
o Audotable	Elev./depth bottom of seal. Type of sand pack. 20-40 Sil Depth of top of sand pack. Elev./depth top of screened section: /" Pu Describe openings-020" Factor	1(a) SAURO // 1. /3 C. Saul 40
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Dote Completed 6/13/91 Of Inspected By H. MERRELL	riginal Depth 45	Page of Well No. <u>VESP-8B</u> SCREEN Depth Interval 42-43'
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Ground Elevation B" x/2" Locking Alush Mount Protective Cover 100 100 100 100 100 100 100 1	Depth of surface seal below grantface Type of surface seal:Concret I.D. of surface casing. Type of surface casing. Type of surface casing below grantface. Depth of surface casing below grantface. I.D. of	SHEET 8" SHEET 8" Fround 1ft 1" QD. PVC 8" 4//PS 40 1/2 40 5/ok 1" O.D. ction.\ 43

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Date Completed 6/1 Inspected By H. ME	3/91 Original Depth.		Page _ l of _ l well No. VES P - 8C SCREEN epth Interval 55-56
Ground Elevation B"x/2" Locking Flush Mount. Photechix Cover	Depth of surface Type of surfa	surface seal below grows surface seal: Concret rface casing. surface casing: GALU. Surface casing below grows on TUBINCI The pipe. I Schol 40 of borehole ackfill: BENTONITE CHA the bottom of seal. Indeport seal.	SHEET 8" SHEET 8" OUND 19T 1" OD. PUC 8" 2
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PROJECT NO. 89M114G1 (Wes 9948)

SHEET ___OF_2

Woodward-Clyde Consultants PROJECT NAME RMA COE MOTOR TOOL VES HOLE NO. VESP-8A

		GRAPH			ŧ		MPLES	REMARKS
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RING	LOCATION SEC 4			ELEV	ATIO	N AND	DAT	UM		S_HOLE NO.VESP
	G AGENCY LAYNE ENVIRONMENTAL DRILLER D. W	ERNER		DATE	FHI	RTED	6		3/9	6/13/91 SAMPLER
	G EQUIPMENT CME-75					OH E		7	15	
ILLING	G WETHOD Hollow STEM Auger DRILL BIT	8 ′		SA	IO. O	5	DIST			UNDIST.
ZE AN	10 TYPE OF CASING / " Sched 40 PVC		,		ATE F		FIRS	1		COMPL. 24 HRS.
PE OF	PERFORATION FACTORY SLOTS . 020" FROM 44	1043	FT.		GED W.	by MER	PPE	, ,		CHECKED BY
ZE AN	10 TYPE OF PACK 20-40 SILICASAND FROM 45	10 40	100	,,.	••••	(4.)		LL		
PE OF	SEAL BENTONITE CHIPS FROM 40	TO /	FT							
FCET)	DESCRIPTION	GRAPH- Lithology	Pleze		Woter	Plezon etc Date	9	\$ 11 MOO	Penetra Beset (8 bese 6 In)	REMARKS (Drill Rate, Fluid toss, Oder, etc
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FROJECT NO. 89 M 114 G (Wes 9948)

SHEET ___OF_6

Woodward-Ctycle Consultants PROJECT NAME RMA COE MOTOR POLL VES HOLE NO. VESP-8B

	GWard-Cryde Constitution - PROSECT MARK	GRAPH	C LOG	. =	2	_	MP	LES	
KI d 30	- DESCRIPTION	Lithology	Pleasenator Installettor	Water	Pierome Dote	Type No.	Recor. fi	Marie Constitution of the second seco	REMARKS (Drill Rule, Fluid loss, Odor, etc.)
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10	Songht Yellow Brown				1				·
11	F-Cg, Subk-Subeni Moist, Prox Geades								
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PROJECT NO. 89 M 114G1

(9948)

SHEET 2 OF 6

Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POLYES HOLE NO. VESP-8 B

	art or you constant to the same	GRAPH	c Los	_	<u> </u>	_	MPLES	
0£ PTH (FEET)	DESCRIPTION	Lithology	Plezometer Installation	Water	Piezomet Dofa	Type Ma.	Pacor. T	REMARICS (Drill Rule, Fluid loss, Ddor, etc)
17 18 19 20 20 19 20 19 19 19 19 19 19 19 19 19 19 19 19 19	Cloyer Soud LT Yellow Ben (Munsell) 104R 4/4 F-Cg Poor Greded Movil)				
2 2 2 2 2 3 3	TR Fine Growel & Gml							
24 25 PROJECT	NO. <u>B9M114G1</u> (9)	748)						SHEET <u>3</u> OF <u>4</u>

Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POLL VES HOLE NOVEST-8 B

		GRAPHI	c LOG		٤	SA		LES	
DEFTH (FEET)	DESCRIPTION	Lithology	C LOG Plezometer the tolletion	Water	Pie zome Data	Type Na	Recor. ft	Section of the sectio	REMARICS (Drill Rule, Fluid loss, Odor, etc)
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PROJECT NO. 89M 1146-1

(9948)

SHEET 4 OF 6

Woodward-Clyde Consultants PROJECT NAME RMA COE MOTOR POOL VES HOLE NO. VESP-88

		GRAPH	ic Los	-	3	\$4	MP	LES	
(FEET)	DESCRIPTION	Lithology	Plezometer Installighter	Water	Pie romet Date	Type Na	2 PECON. #	0.00 mg mg mg mg mg mg mg mg mg mg mg mg mg	REMARKS (Drill Rule, Fluid loss, Odor, etc
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	NO. 89M114G1	(994	8)						SHEET 5 OF

Woodward-Clyde Consultants PROJECT NAME PMACOE MOTOR POOL VES HOLE NO. PO 8 B

			GRAPHI	c roe	. =	ž.	4	MPLES	-	-	
(FEET)	DESCRIPTION	[Lithology	Pleasmeter Installation	Conte	Piezome Date	Type No.	Person.	E (Drill	REMARKS	
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podward-Clyde Consultants PROJECT N			ELEV	VATIO	H AM	D DAT	UM		,	
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ILLING EQUIPMENT CME-75			COMI	PLET	ION I	EPTI	3	8	SAMPLER	
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pe of perforation Factory SLots . 020" FROM 56	10 53	₹ 1.	LOG	GED	BY				CHECKED E	IY
LE AND TYPE OF PACK 20-40 SILICA SAND FROM . 58	10 5	_	H.	W./	MER	RE	LL		1	
PE OF SEAL BENTONITE CHIPS FROM 53	10 2	FT								
DENICH IE CAIPS	GRAPH	IC LO	G		<u>}</u>	Ş	MP	LES		
DESCRIPTION	Lithology	Pleaton	seter	to of	0.0	Z Z	듺	5 4 B E	R	EMARKS
S .	CC.O.	tractal fo	ation	28	Plezon	Type	2	(B)	(Drill Mate, I	Fluid loss, Oder, etc.)
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Woodward-Clyde Consultants PROJECT NAME RMA COE MOTOR POLL VES HOLE NO. VESP-8C

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	(FEET)	DESCRIPTION	Lithology	Pleasome ter and tol let for	Wole	Pierome Data	Type Ma	Recor. f	Penetra Regist Blows 6 in)	REMARKS (Drill Role, Fluid loss, Odor, etc)
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	10	SAND LT VOLLOW BRD					F			
	-	SAND LT YELLOW BRD F-Cg, Sab &-Sub RND Moist, Poor Graded				-	-			
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PROJECT NO. 89 M 114-61

(9948)

SHEET 2 OF 7

Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POLL VES HOLE NO. VESP-8C

		GRAPHI			5	SAI	IPLES .	
DEPTH (FEET)	DESCRIPTION	Lithology	Piezemeter Installetion	Conten	Pieromet Date	Type Ho.	Principal Princi	REMARKS (Drill Rate, Fluid loss, Odor,etc)
/6-	Clayer SAND LT Yellow BRN Munsell 10 YR 4/4 F-Cg , Sub & Sub Rus. Moist , Poorly GRADID	· · / · / · · ·			{			
18	(SP)	/						
20	1+ Fine Gravel 5'							
22-	Lit Fine Grewel & Grit 18" - 44"							
<i>23</i> -								
24-								2 7

PF. DJECT NO. 89411461

(9948)

SHEET 3 OF 7

Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POL VES HOLE NOVESP-BC

		GRAPH	C TOC	- =	ŧ	4 1	MPLES	REMARKS
(FEET)	DESCRIPTION	Lithology	Pleasometer trestolistics	Wet. Conte	Pleton	Type No.	Pacor. f.	(Orill Rels, Fluid loss, Odor, etc
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PROJECT NO. 89M 1146-1

9948)

SHEET 4 OF 7

Woodward-Clyde Consultants PROJECT NAME RMA COE MOTOR POOL VES HOLE NO. VESP-8C

		GRAPH	C LOG	_	-	54	MP	LES	
OEPTH (FEET)	DESCRIPTION	Lithology	Plezometer Installation	Woter	Piezomete Dote	Type Ma	. £	Panate, Realst Blown 6 h)	REMARKS (Drill Role, Fluid loss, Odor, etc)
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‡	LT Yellow BEN	1./0/	4		:	<u> </u>		1	
Ŧ	Sondy, Clay Lt yellow BEN Fg, Sub 4-Sub rd 1% Gr.t. ÉClay (SC/CL)	Y//	1		-	+			
‡	1% Gr.t.	1//	4	1	:	Ŧ			
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POJEC	T NO. <u>BDM114G1</u>	(9948)			_		SHEET 5 OF
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Woodward-Clyde Consultants PROJECT NAME PMACOE MOTOR POOL VES HOLE NO. VESP-80

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		GRAPH	IC TOE	- 5		9	Ξ	4 -	REMARKS
OEPTH (FEET)	DESCRIPTION	Lithology	Pleasmeter tretolistion	Conte	Pie ton	Type N	Aecor.	Residence of the Party of the P	(Drill Refe, Fluid loss, Odor, etc.)
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	Lit Clay LT Yellow Bei Med plastic	<i>'.</i> .			1	-			
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46.	SAND Sci Clayey LAT Yellow BIEN				-	-			
- 1	F-C51 365					-			
47.	Poor Gredd Mois"-	٠. ٠				-			
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PROJECT NO. 89/11/1461

(9948)

SHEET 6 OF 7

Woodward-Clyde Consultants PROJECT NAME PLACOF Motor Pod VES HOLE NO. VESP-80

		GRAPHIC LOG		. =	\ <u>.</u>			LES	REMARKS	
(FEET)	DESCRIPTION	Lithology	Pleasmeter inetalistics	Wote	Ple tome! Date	Type Ha	SCO.	Religion (P. P. P. P. P. P. P. P. P. P. P. P. P.	(Drill Rate, Fluid loss, Odor, etc)	
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Ŧ	Clayer SAND 27 Yell-BRU F-GJ Sub 4-Sub Rnd 10-6 Fines, Low plastic TR grit.	1./.					П			
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	NO. 89M114G1	1	9948	2)					SHEET 7 OF	

BORING LOCATION Sec 4 RMA DRILLING AGENCY Layne Western DRILLER D. WERNER DATE STARTED DATE STARTED			
MENT 1 AND THE STATE OF THE STA	-	1/	01_ ///6
		76/	9/- 6/6/91 SAMPLER
10/201	DIST.	30	UNDIST.
REGION SHAPELES	FIRST		COMPL. 24 HRS.
ZE AND TYPE OF CASING 4-4 PUC Sched 40 WATER ELEV. PE OF PERFORATION 020 TO /2 FT. LOGGED BY			CHECKED BY
10 ZD 28 13 U W MC	PDE	-11	
	/\	LL	
PE OF SEAL Bentonita FROM 11 TO 5.5 FT GRAPHIC LOG 1	T SAL	APLES	
DESCRIPTION Lithology Pleasomator total deficion	1	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	REMARKS (Drill Rate, Fluid loss, Oder, et
= 2 inch grovel 2"deep at	Ŧ		Grovelfor RR Ballast
+ Seater Com 12/2 (Relliast) /a/	Ŧ		DGIIGEI
	+		
I Theyer Clayer Sons, F-Magrain //	ŧΙ		
I Simicageous, Poor Graded, Sub & / , /	£Ι		
I Sand 90% , moisti	±		
Steven Clayer Sond, F-Madgrain, Stimicaceous, Poor Goded, Sub 4. Sand 90%, moist; Munsell 10 YR 3/4	ŧΙ		
+ /	ŦΙ		
I dark yellowish Brown !!	Ξl		
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$-\frac{1}{2}$ (SC) $ \cdot \cdot \cdot \cdot \cdot \cdot \cdot \cdot \cdot \cdot \cdot \cdot \cdot \cdot \cdot \cdot \cdot \cdot \cdot$	t I		
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			GRAPHIC LOG		ž	54	W	LES	BEHLDING.	
	(reet)	DESCRIPTION	Lithology	Plezometer Inetal lation	Water	Ple tome Date	Type Ha	Recor, fi	Parate Resist	REMARICS (Orill Role, Fluid loss, Odor, etc)
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Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR Paul VES HOLE NO. VES-3

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1	- TE Clay balls - 10YR 4/4	V	1		-	‡,			
‡						‡			
24	TR 1/4-1/8" grit	∤			-	+			
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~ T	CT NO. 89M 114G1 (994)	3)							SHEET 3 OF

Woodward-Clyde Consultants PROJECT NAME PMACOE MOTOR POOLUES HOLE NO. VES-4

) 0EPTH (FEET)	DESCRIPTION								
05		Lithology	Piezometer inetalistics	Water	Pie romei Date	Type No.	Recor. f	100 G	REMARKS (Drill Role, Fluid loss, Odor, etc)
26	Clayer Sand Willow BED 10 XR 34 (Munser) Moist, F-Mg Sand, Sub Rubel; the fining mind sub-ond grt 1/4" & Fg grand up to 1/2" (2-3%).	· / · / · / · · · / · · / · · · / · · · / · · · / · · · / · · · / · · · · · / · · · · · / · · · · · · / · · · · · · · · / · · · · · · · · / ·			<u> </u>	£4	8		
30	7.0								Nothing above Background of 0-2 ppm on P.I.D.

PROJECT NO. <u>89 M 114-61</u>

(9948)

SHEET 4 OF 4

DRILLING AGENCY Layre Western DRILLERD. Werner DATE STARTED C/7/9/ DRILLING EQUIPMENT CME 75 DRILLING METHOD Hollow Stem Auge DRILL BIT 6/4 1D NO. OF SAMPLER SIZE AND TYPE OF CASING A" PUC TYPE OF PERFORATION Foctory 5/5 020 FROM 5B TO 43 FT. LOGGED BY SIZE AND TYPE, OF PACK Sond 6-9- TYPE OF SEAL Benton, the FROM 4D TO 35-FT TYPE OF SEAL Benton, the DESCRIPTION Lithology Plazonator 35 5 5 6 6 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8		iward-Clyde Consultants PRO	JECT N	AME _~		FI EVATE) AN	D DAT			HOLE NO.V			
BALLING WEINSON CAME 75 PRILLING WEINSON LAW TO THE TO PACK SCHOOL AND THE TOP TO PACK SCHOOL AND THE TOP TO CASHING AT PLL THE OF PERFORATION FC. Lawy Clif O 20 FROM 5B TO 43 TK. SIZE AND TYPE OF PACK SCHOOL AND THE TOP OF TOP OF TOP OF TOP OF TOP OF TOP OF TOP OF TOP OF TOP OF TOP OF T						ELEVATION AND DATUM								
DRILLING WETHOD HOLD Shem Aufter DRILLING WETHOD HOLD Shem Aufter DRILLING WETHOD HOLD Shem Aufter DRILLING WETHOD HOLD Shem Aufter DRILLING WETHOD HOLD SHEM AT PUC THE OF PERFORATION Ecology She O20 FROM 5B TO 43 FT. UNDIST. DRIST AND TYPE, OF PACK Sond 6-9- FROM 40 TO 35-5T TYPE OF SEAL Bendon to 1800 AD 11. THE OF SEAL Bendon to 1800 AD 10. DRISTIPHON DRISTIPHON DRISTIPHON DRING PROBLEMANS ORAPHIC LOG BRIMANS ORAPHIC LOG THOMAS AND THE SHEM BOWN Clayer Sand, Dark Yellow BOWN TO ST. The Soil BLL - DR Gy Clayer Sand, Dark Yellow BOWN The Soil BLL - DR Gy The Soil		MILLING AVERLY Layne Western DATE FINI						م)	4	// 7/	SAMPLER			
SIZE AND TYPE OF CASING 4" PUL THE OF PERFORATION FOLLOWS SIST DZ O FROM 5B TO 43 FT. SIZE AND TYPE, OF PACE SOND 6.9- TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF SEAL BONDON to 1900 GO TO 35- TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF SEAL BONDON to 1900 GO TO 40 FT. TYPE OF PERFORATION GO TO 1900 GO TO 40 FT. TYPE OF PERFORATION GO TO 1900 GO TO 40 FT. TYPE OF PERFORATION GO TO 1900 GO TO 40 FT. TYPE OF PERFORATION GO TO 1900 GO TO 40 FT. TYPE OF PERFORATION GO TO 1900 GO TO 40 FT. TYPE OF PERFORATION GO TO 1900 GO TO 40 FT. TYPE OF PERFORATION GO TO 1900 GO TO 40 FT. TYPE OF PERFORATION GO TO 1900 GO TO 40 FT. TYPE OF PERFORATION GO TO 1900 GO TO 40 FT. TYPE OF PERFORATION GO TO 1900 GO TO 40 FT. TYPE OF PERFORATION GO TO 1900 GO TO 40 FT. TYPE OF PERFORATION GO TO 1900 GO TO		C/9E 13			70				4	0_				
SIZE AND THE DESCRIPTION TYPE OF REFORATION For boary 5/st 020 FROM 5B TO 43 FT LOGGED BY SIZE AND TYPE, OF PACE SOND G.9 FROM 40 TO 35-TT TYPE OF SEAL BONDON; to PACE SOND G.9 FROM 40 TO 35-TT TYPE OF SEAL BONDON; to PACE SOND G.9 FROM 40 TO 35-TT DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION RELIANCE	DRILLIA	NG METHOD LIONION Stem Auge 10	RILL BIT	6/4 1	D			<u> </u>						
SIZE AND TYPE, OF PACK SOND GO TO 40 TO 35TT TYPE OF SEAL Bendonite DESCRIPTION LIMINITY PRODUCTOR SEAL BENDONITY ORATMIC CONTROL GROUP (R.P. Ballost) 2" Volc. Groupe (R.P. Ballost) 2" Soil BLE - DEGY Cleyer, Sond, DARK Yellow BRN Munsell 104R 4/4 F-Mg, Sub 4 - Sub Rnd, 2" From Size Was Plant Size REMARKS ORATMIC CONTROL SIZE ORATMIC SIZE	SIZE A	7 100						FIRS	_					
SIZE AND TYPE, OF PACK SCALES OF PACK SCALES OF PROBABILIST OF SEAL Bendonite PROBA 40 TO 35"T TYPE OF SEAL Bendonite PROBA 40 TO 35"T BESSET DESCRIPTION REMARKS OF SEAL BENDON REMARKS OF SEAL		OF PERFORATION Factory 5/of 020 15	RON 58			LOGGED	B Y				CHECKED BY			
DESCRIPTION DESCR	SIZE A	IND TYPE, OF PACK Soud 6-9-	NOM GC	10 48	FT.									
DESCRIPTION DESCR			NOM 45	⁷⁰ 35	-FT									
2" Volc. Grovel (R.F.Ballost) as 2" Soil BLE - DEGY Clayer Sand, DARE Yellow BRN Munsall 104R 4/4 F-Mg, Sub & - Sub Rnd, Moist. Less than 5% 1 fines. Non Plestic Clay moterial SC) As About W/ Clay Mer. to ~10%	×-				_	6 ,=	1			LES	BENARYS			
Clayer Sand, DARK Yellow BOW Munsall 104R 4/4 F-Mg, Sub & Sub Rnd. Moist. Less than 5%. 2 fines. Non Plastic Clay moterial SC) As About Wy Clay Mur. to ~10%.	1334	DESCRIPTION		Lithology		etien	9190	1770	Recov,	Bost a				
Clayer Sand, DARK Yellow BOW Munsall 104R 4/4 F-Mg, Sub & Sub Rnd. Moist. Less than 5%. 2 fines. Non Plastic Clay moterial SC) As About Wy Clay Mur. to ~10%.		2" Volc. Grovel (R.P. Bal	lost)											
Munsell 104R 4/4 F-Mg, Sub X-Sub Rnd, Moist. Less than 54. I fines. Non Plastic Clay moterial As About W Clay Mer. to ~10%		2" Soil BLE-DEGY					=							
Munsell 104R 4/4 F-Mg, Sub X-Sub Rnd, Moist. Less than 54. fines. Non Plastic Clay moterial As About W Clay Mer. to ~10%		Ckye, Sond, DARK Yellow	Ben	/										
As About Wy Clay Mur. to \$10%		Munsell loye 4/4					=	F			·			
2 Moist. Less than 5%. fines. Non Plastic Clay moterial SC) As About W/ Clay mer. to ~10%				• /				-						
fines. Non Alestic Clay moterial SC) As About wy Clay Incr. to \$210%														
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As About W Clay mer. to 210%		•	icy				=	-						
As About Wy Clay Mer. to ~10%	‡	inciterial (SC) ′	۲. ·			=							
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Woodward-Clyde Consultants PROJECT NAME RHA MOTOR POLVES HOLE NO. VES 4

		GRAPHI	C LOG		3	SA	MF	LES	
OEPTH (FEET)	DESCRIPTION	Lithology	Pleasmeter metalicitor	erote.	Dofe	5	9.	1 0 G	REMARKS (Drill Rule, Fluid loss, Odor, etc.)
25			200101010	- 0	34	Type	Recor	E 200	Contract, value assignment
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1' -	: Lloyey 2 and, DRK Yellow,	/ ·]				
E	Cloyey Sand, DRK Yellow Brown (Munsell 104R4/4	Y · · /	1		4	_			
1 3	41	. ·/.			1				
	Med-Coarse grained, Sub & - Sub Rad, Very	/.			1	-			
11]	CIX-Sheet Vous				1 3				
1 1	306 4 - 300 RAE, VEN	. /]		ı		j
1 -	SLi compact of fines 65%	/		1		-			
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1/2	- Moist	/			-	_			
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PROJECT NO. 9948

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SHEET 2 OF 7

Woodward-Clyde Consultants PROJECT NAME RHIS MOTOR POUL VES COEHOLE NO. VES -4

		GRAPH	c LOG	. =	3	\$4	MI	LES	
06 PTH (PE ET)	DESCRIPTION	Lithology	Plezometer tnetoliation	Wote	Piezome Date	Type No	Ascor. f	Presta Bloss in in	REMARKS (Drill Rale, Fluid loss, Odor, etc)
16-		• •				-			
	Sand Med, Course Gr		,		1				
1 3	_				1				
17	Sup &, Sub Rud, Pau Sont.	,				-			
1 1	with 5% FineGrow								,
1 =	= 3/16 - 1/4" Sub roded gr	, .				_			
	- Poorly Sorteb	, . `]				
/B-		0,							
1 3	moist. (SP)	/			-				
1 1		·/.]				
19 -					-				
1 1						1			
1 3		. /							
0-	Call Nu DIVIII BOD	/, ·				-			
	Sand DK Bod Yellow BRN								
	Munsell WYK 4/4	0.							
2,	Sond, Med-Coovergr	٠.]				
	Sub 4 - Sub Rnd.								
1 4									
	10% Fine gravel 18"-	· .							
22	Staining Ground Fregs	Ò				-			
1 3	Steining Ground fregs.				1				
1 3	No Odor, Moist	. '							
23	(SP)				1	-			
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	-					F			
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25-	COUR COMULACIO			L			1		1

PROJECT NO. 9948 89M 114 G1

SHEET 3 OF 7

Woodward-Clyde Consultants & PROJECT NAME PARCOE Motor Park UES HOLE NO. UES-4

	PROJECT NAME	GRAPH	C 106	_	<u>. </u>	SA	MPL	ES	
) (FEET)	DESCRIPTION	Lithology	Plezometer inetal lat las	Water	Plezomete Date	Type Na.	= 2	# B C E C E E E E E E E	REMARICS (Drill Role, Fluid loss, Odor, etc)
25-	Sand Dt Yellow BRN C-VC grained, 5464- Sub Rnd, Moist:; pour Fine Grovel 18-14" Sub Rnd. (20%)		·		1				\
27	Fine Growel 18 - 14" 55 506 Rnd. (20%)	0							
2੪ -		0				مسلمين			
9		. 0				Landanala			
30-					al .	ll			
31									
32-	Sond, DK BEN, F-Mgr					· · · · · · · · · · · · · · · · · · ·			Drlg 5/bunch at
34	Munsey 104R 4/3, moist 15% Fine Grovel 14-1/2"	00.			-				00577 4/ 05 7

Woodward-Clyde Consultants PROJECT NAME EMACOF MOTOR POOL VESHOLE NO. VES-4

	T	GRAPHI	C LOG		2	54	AMI	LES	
() () () () () () () () () ()	DESCRIPTION	Lithology	Piezerneter metal lettor	Content	Plezomet Date	Type Na	Recor. ft	Manie Bioles A de Car	REMARICS (Ortil Role, Fluid loss, Odor, etc)
34-	Sand DEBON F-Mg maist, Subt- Subtand	00			1	-			
	maist, Sub & - Sub Rad		,						
	10% Gravel 44-318 raysub Rd								
35-		0.				-			
	<u> </u>								·
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26		. ;]				
	Clayer Sand DK Yellow BRD	///							
-	Munsell 104R 4/4	11:	ļ						
	Silty Mixtures	1//]	Ė			·
31-	(3X/8E)(ML)	///:							
		1//			=	-			
	fines = 10-15%	///:				-			
38-	1 John 199	()							
-	with occasional "e" grit.	./,			=	F			
	‡	1/1.							
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40-	<u>'</u>	. 1/.			-	-			
	3	· . ,				<u> </u>			
	Clayey Sand DK. Yell. BEN	1/1				F			
41.	F-Mg, Sub x-Sub End	1.11	1		-	-			
	4	1				ŧ			
	fen 1/3" grit greins	1,1	1		-	+			
42	‡	./.			-	-			
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PROJECT NO. 9948 (WLFS)

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SHEET 5 OF 7

Woodward-Clyde Consultants PROJECT NAME PMACOE Motor Park VES HOLE NO. VES-4

	GRAPHIC LOG &					54	MP	.ES			
DEPTH (FEET)	DESCRIPTION	Lithology	Pleasanter sectol letter	Woter	Ple zome Date	Type No.	Recor.	# (E	REMARKS (Drill Role, Fluid loss, Odor, etc)		
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-11		•/			4	•					
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5	CI CI S	/.			1	-					
	Clayer S. Hy SAND De Yellow BRN.				1	-					
, :		1/_			1						
- مرا :	Munsell 104R 4/4 F-C grained Sub End.				1						
		0/			111						
7	Fines = (10-15-%)	/.			1	_					
	Moist. Fines = (10-15-%) Forcuel 1/8-3/8" (20/6)]						
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-رح :	(5.6)	/,									
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PROJECT NO. 9948 (WCFS)

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SHEET 6 OF 7

Woodward-Clyde Consultants PROJECT NAMERA COE Motor Puol VES HOLE NO. VES-4

OF (FEET)	DESCRIPTION	GRAPH!	Pleasonater Installation	Woter	ezometer Data	g g	SQ. C	E3 (F	REMARKS (Drill Role, Fluid loss, Odor, etc.)
52-	-				<u>e</u>	Тур	Reco	1 œ -	
7	Clayey Sity Sand DK Yellow BEN 10 YR 4/4 (Munsell)	,	, .		1000				
1		·/.							
54	- Sub K. Moist. Little Fine Corevel	0			1, 1, 1, 1,				
55	1/8-1/4" Sub Rad-	/ · · /							
7	(5c)	8.			111111				
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PROJECT NO. 9848 (WJS)

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SHEET Z OF Z

		ELEVATION AND DATUM							
LLING AGENCY Layne Environmental DRILLER D.	WEEN	ER	DATE	FINE	MTED SHED	6	//	1/91	- 6/11/91
LLING EQUIPMENT CME 75					OH D	EPTI	1	5	SAMPLER
LLING METHOD/Hollow Stern Auger DRILL BIT	METHOD Hollow Stem Auger DRILL BIT 8" NO. OF SAMPLES DIST.							UNDIST.	
E AND TYPE OF CASING IN PUC		,		WATER FIRST ELEV.			ज		COMPL. 24 HRS.
FOR PERFORATION I" PUC FACT STOTE 020 FROM /3	10/2	FT.	LOGG	ED	6Y	-4=	20	"//	CHECKED BY
E AND TYPE OF PACK SILICA 20-40 FROM 15	10/0	FT.	11.	W.	ME				
e of seal Berton, te IFROM 10	, TO Z	FT							
	GRAP	IIC LC			Ł	S	MP	LES	
DESCRIPTION	Lithology		mater lation	Conten	Piezon	Type Me	Recov, ft.	Penatra Rosht (Bbon) 6 In)	REMARKS (Drill Rate, Fluid toss, Oder, etc
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+	<i>Y</i> • • •		1	1	4	_	П		
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+ May , croquer, in yerrowne	4 .				Ŧ		П		
I F-ME I Subx - C. L. D. J.	1/	1			7	-	П		
1 July South John	/				1	•	П		
SAND, Cloyen, LT Yellow Be F-Mg, Subx-Scho Rnd. Sci smount of Cloy. Moist	' '				+	_			
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Woodward-Chyde Consultants PROJECT NAME RMA COE Hotor Pol VES HOLE NO.

	GRAPHIC LOG SAMS						MPLE	S	
O E E	· DESCRIPTION	Lithology	Pleasmeter Installet lar	Weter	Plezone Dafe	Type Ma	Penetre.	E S	REMARICS (Drill Rate, Fluid loss, Odor, etc)
7-	45 ABour (SC)	· · / ·	,		*				
8		 /.							·
9		(
10	SAND, LT Yellow BRN, SUB 4-Sub Rrd, Moist				*				
1 -	Plox-Graded (SP)					_			
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1/5-	T.D.				1.111111111111				
PROJ	ECT NO. WCC 89M114G1	9948)	_	1		11		SHEET 2 OF

ING L	ocation Sec 4	A L. Ford			ELE	VATIO	N AN	DAT	UM		S HOLE NO. SP. S.
	AGENCY /	Environ mente	/ DRILLERD 4	Jemer	DAT	E 51/	RTÉD SHED	4	7	10/9	1-6/10/91
	EQUIPMENT CME		7		CO	PLET	IOH C	EPTH			SAMPLER
LLING	METHOD Hollow St	-/3	DRILL BIT 3 3/4 10 HSA SAMPLES DIST				DIST.			UNDIST.	
E AND	TYPE OF CASING	1º AIC	Sil-led to	, , ,	-	WATE	1	FIRS	1_	_	COMPL. 24 HRS.
	PERFORATION Fact			TO 36	FT. LO						CHECKED BY
E AND	TYPE OF PACK 20	240 Flor	FROM 39	TC 34		. W.	ME	(C)	4		
E OF	SEAL Benton. Le	11 1 01 0	FROM 34	1020	7 47						
	Denton, 40	Med Chips	1 .~/		IC LOG		2	SA	MP	LES	
466.1		DESCRIPTION		Lithology	Plazomete		Plezon Dote	He	Recorft	====	REMARKS
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Woodward-Clyde Consultants PROJECT NAME RMACOE Hoto-Po-1 VES HOLE NO. VESP-5B

		GRAPH	c roe	. =	3		-	LES	
(FEET)	DESCRIPTION	Lithology	Pleasmeter metalistics	Conte	Ple tome Date	Type No.	ecov.	Penales Resist 6 in the	REMARICS (Drill Rele, Fluid loss, Odor, et
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Woodward-Clyde Consultants PROJECT NAME RMA COE Hoto & Fol VES HOLE NO. ST

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(reer)	DESCRIPTION	Lithology	Plezemeter Installet los	Conte	Pletom	Type N	Pare Pare Pare Pare Pare Pare Pare Pare	REMARKS (Orill Rule, Fluid loss, Odor, et
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Woodward-Chyde Consultants PROJECT NAME EMA-COE Motor Pool UES HOLE NO. _____ NO. _____

	Ward-Cryde Consultants PROJECT NAME	GRAPH		. =	<u> </u>	SA	МР	LES	
OEPTH (FEET)	· DESCRIPTION	Lithology	Plesometer sectol latter	Weter	Plezonet Dafe	Type Na.	Recor. ft	Penetra Realst Blove 6 h)	REMARICS (Drill Male, Fluid loss, Odor, etc)
25-	Sons LT yellow BEN				1 1				
26-	Sour LT yellow BRN Munsell) 104R 4/4 F-Cq moist. Subx-Sub Rnd.								
27-	(SP)	• •							
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31	CLAMEY, SILTY SANTS, LT YELLOW BEN, Moist Subat-Sub End.	11.							
32-	(Sc)(ML)	11.							
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34	89M //4C1 894					E_			SHEET 4 OF

PROJECT NO. 89M [146]

(9948)

SHEET 4 OF 5

Woodward-Clyde Consultants PROJECT NAME RMA COF MOTOR POOL VES HOLE NO. VEST-5B

DESCRIPTION Linkstep Production \$\frac{1}{2} \frac{1}
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Woodward-Clyde Consultants PROJECT NAME MOTOR POOLAREA VEP COEHOLE NO. VESP-5C
BORING LOCATION AND DATUM

	LOCATION Section 4 RMA	OJECT N	ANIL 2	E	LEVATIO	N AN	DAT	UM			
	NG AGENCY LAYNE ENVIRONMENTA	DRILLERD, L	VERNE	P 8	ATE STA	RTED	6,	110	121	- 6	10/91
L	IG EQUIPMENT CAF 75			,	OMPLET	OH C	EPTH	1		SAMPLER'	
DRILLI	NG METHOD LOKKW Sten Auger	DRILL BIT			NO. O	F S	DIST			UNDIST.	
SIZE A	IND TYPE OF CASING /" PVC			$\neg \uparrow$	WATER	1	FIRS	T		COMPL.	24 HRS.
TYPE C						CHECKED !	IY .				
SIZE A	NO TYPE OF PACK 20/40 Silica Sold	FROM 54 1/2	10 50	FT.	H. M	cry	41				
		FROM 50	1044								
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DEPTH FEET)	DESCRIPTION		Lithology	Plezon tretelet	oter in the least	Plezon. Dote	A R	뒿	1 1 E	(Delli Boto	EMARKS Fluid loss, Oder, etc.)
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Woodward-Chyde Consultants PROJECT NAME



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	DESCRIPTION	Lithology	Plesometer metalistics	Conten	Piezome Date	Type No.	Recor.	Bioga E	REMARICS (Drill Role, Fluid loss, Odor, etc)
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PROJECT NO. 89M [146]

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SHEET 2 OF Z

Woodward-Ctycle Consultants PROJECT NAME RMACOE MOTOR POOL VES HOLE NO. VESP-5C

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(FEET)	DESCRIPTION	Lithology	Plezometer metelictics	Con	P.6 10	Type Ma	Recor.	200 6 5	(Ortif Rule, Fluid loss, Odor, etc
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Woodward-Clyde Consultants PROJECT NAME RMACOE Motor Pol VES HOLE NO. VESP-50

	d-Clyde Consultants 🍑 Pi			GRAPHIC LOG - 5 SAM				\Box	BEHLEVE	
(reer)	DESCRIPTION	Lithology	Pleasmeter inetal latter	Conten	Plezometer Date	Type No.	Penette. ft	0 S	REMARKS (Drill Role, Fluid loss, Odor, etc.	
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Woodward-Clyde Consultants PROJECT NAME RMACDE Motoe Par VES HOLE NO. VESP-5C

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PROJECT NO. 89M11461 (9948)

SHEET 5 OF L

Woodward-Chyde Consultants PROJECT NAME RMACOE NOTOR POOL UES HOLE NO. VESP-5C

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PROJECT NO. 89M 114-61

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SHEET 6 OF 7

Woodward-Clyde Consultants PROJECT NAME PHACOE MOTOR POL VES HOLE NO. VESP-5C

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	DESCRIPTION		Lithology	Plezometer sectol letter	Conten	Piezome Dofe	Type Ha	Person Person Blow 6 h)	REMARKS (Orill Rule, Fluid loss, Odor, et
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Woodward-Clyde Consultants PROJECT NAME COE MOTOR POL VES HOLE NO. VESP-6A DRILLER D. WERNER DRILLING AGENCY LAYNE ENVIRONMENTAL DRILLING EQUIPMENT CME-75 COMPLETION DEPTH DRILLING METHOD HOLLOW STEM Auger DRILL BIT WATER ELEV. COMPL TYPE OF PERFORATION FACTORY SLOTS . 020" FROM LOGGED BY CHECKED BY H.W. MERRELL SIZE AND TYPE OF PACK 20-40 SILCA SAND TYPE OF SEAL BENTONITE CHIPS 01 GRAPHIC LOG REMARKS DESCRIPTION (Drill Rate, Fluid tose, Oder, etc.) SANDI SLI CKYLY LT Yellow Bea (Munsell) 10 YR 4/4 F-Mg, Sub4-Sub END Moist, POORLY GRADED

Woodward-Clyde Consultants PROJECT NAME RMA COE MOTOR POLL VES HOLE NO. VESP-GA

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PROJECT NO. 89 M [14-G]

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SHEET 2 OF 2

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IZE AND TYP	E OF PACK 20-40 Silica SAND	FROM 44	10 40	FT.	77.	W.7	"IEK	RE	LL		
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Woodward-Clyde Consultants PROJECT NAME RMA COE MOTOR TOOL VES HOLE NO. VESP-6B

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	ECT NO. 89 M 114-G1	(9948)						SHEET 2 OF

Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POLL VES HOLE NO. VESP-GB

	rd-Clyde Consultants PROJECT NAM	GRAPH			<u>}</u>		_	LES	
(reen)	DESCRIPTION	Lithology	Pleasmeter Installation	Woter Conten	Date	Type Na.	90	Parette Residence Biographics	REMARKS (Drill Rule, Fluid loss, Odor, etc.)
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Ī	SAND, Growly LT Yellow BRN (Munsell) 104R 4/4 F-Mg - TE 1/8" Growd T-Mg - Sab &					ŧ			
20+	SALED Comments	1.				F			
‡	DAND, Grovery	,			1	‡	۱	1	
Ŧ	LT Yellow BRN					Ŧ	۱		
#	(Munsell) IDYP 4/4	D				Ξ			
21 +	The " company	1.			-	‡		1	
· ‡	F5/95 = 10 18 BROW					‡	١	1	
Ŧ	F-Mg-5ab 4	` ,		1	-	Ŧ	1		
‡	Moust POORLY GRADED	1.			1	‡	١		
22 ±	F-Mg-Sub 4 Moist, POORLY GRADED (SP)	1 '			-	‡			
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PROJECT NO. 89M 114G1

(9948)

SHEET 3 OF 5

Woodward-Clyde Consultants PROJECT NAME PMACOE MOTOR POL VES HOLE NOVESP-68

		GRAPHI	c roe		ž .		_	LES	REMARKS
(reer)	DESCRIPTION	Lithology	C LOG Plesometer surtailotion	Conte	Plezon Dot	Type No.	Recor.	Parent Billion File File File File File File File File	(Drill Role, Fluid loss, Odor, etc.
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ŧ	SAND LTYEllowBEN F-Cg, S.64-S.6 Rus					Ŧ			
Ŧ	F-Cq, 564-26 1205	0				Ŧ			
±	Most Poorly Grade 6	`, `				ŧ			
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PROJECT NO. 89M 1146-1

(9948)

SHEET 4 OF 5

Woodward-Clyde Consultants PROJECT NAME RMA COE MOTOR POOL VES HOLE NO. VESP-68

	ward-Clyde Consultants PROJECT NAME	GRAPH		-	<u>}</u>	5/	MP	LES	
(FEET)	DESCRIPTION	Lithology	Plesometer Installation	Weter	Piezome	Type No.	BCOV.	8000 6000 6000	REMARKS (Drill Mele, Fluid loss, Odor, etc
	- Lavis Rex				4	-	Ì		
Ŧ	Sans LT Vellow Bed	٠.			1		$\ $		
Ŧ	F-Mg, Sab & - 340 K.	٠ .					П		
16 ±	F-Mg, Sub &-Sub R. Moist Poorly Gradet]	-	П		
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40		11/1				-			
‡	Sandy, SLTY Clay,	1/1.				Ī	١		
‡	- LT Yellow BEN	1.//		1	-	‡			
. ‡	(Munsell) 104R 4/4	1/1.				ŧ			
4	Med Plastic, Moist	11/				ŧ			
‡	-				-	‡			
1	(CL/ML)		-			‡			
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RING	ward-Clyde Consultants PROJECT N			ELEV	VATIO	N AN	DAT	UM		
	G AGENCY LAYNE ENVIRONMENTAL DRILLER D.V	VARNER		DATE	FMI	RTED			2/91	- 6/12/91
	G EQUIPMENT CME-75	23002		COMPLETION DEPTH 58' SAMPLER						SAMPLER
ILLIN		8'		NO. OF DIST.						UNDIST.
ZE AF	NO TYPE OF CASING / Scheld 40 PVC	<u> </u>		w	ATE	~	FIRS	T		COMPL. 24 HRS.
PE OI	F PERFORATION FACTORY SLOTS . 020 " IFROM 56	10 55	FT.	LOG	GED	BY	_			CHECKED BY
ZE AL	NO TYPE OF PACK 20-40 SILICASAND FROM 58			H.	W.	MER	RE.	LL		
PF O	F SEAL RENTONITE CHOS FROM 53	10 /	FT							
	F SEAL BENTONITE CHIPS FROM 53	GRAPH	15 10	G I		•	SA	MP	LES	
(LU)	DESCRIPTION	Lithology	Piezo: Instali		Water	Plezomet Date	Type He.	Record	Boate (Boate	REMARKS (Drill Rate, Fluid loss, Odor, e
+	2" Grovel (P.R. Beliest)	PAKO				-		П		
#]		П		
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#	F-Mg, Sub X - Sub Rad	1 /		- 1	<u>.</u> .	-				
#	F-Mg, 345 & - 365 Km	1/: 1					-	П		
+	Moist Poorly Graded	1					F	П		
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+	TR Clay 67%?	' ' .				-	-	П		
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+	(Munsell) 1048 4/4 /5P)					-	-	Н		
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Woodward-Clyde Consultants PROJECT NAME RMA COE MOTOR TOOL VES HOLE NO. VESP-6C

		GRAPH	c roc		ŧ.,	0 1	MPL Ela	-	REMARKS
	DESCRIPTION	Lithology	Pleasme for Inetal lot los	Content	Ple rom Dof	Type Ha	Parete	Reals Blows F (F)	(Drill Role, Fluid Ioss, Odor, etc
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Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POLLYES HOLE NO. VESP-6C

Description Universal manufactures of the second of the s		tward-Clyde Consultants PROJECT NAME	GRAPH	c roe	.=	<u> </u>	54	MP	LES	
TE 3/8" grove Sub Knd TE 3/8" grove Sub Knd TO Groven Sond AT Yellow DA F-Cq, FR Sub X-Sub End 21 Poorly Groded, Moist 22 (SP)	OEPTH (FEET)	· DESCRIPTION	Lithology	Piezometer tretsliction	Wate	Ple tome Dafe	Type No.	Recor. f	Raine Biose 6 h)	REMARKS (Drill Rate, Fluid loss, Odor, etc.)
TE 3/8" grove Sub Rad 20 Grovery Sand AT Yellow DA F-Cq, FR Sub X-Sub Rad 21 Poorly Graded, Mais; 22 (SP)	17	F-Mg ,506 x-506 Rad				1				
F-Cq, FR Sub X-Sub Cond 21 Poorly Groded, Maist 22 (SP)		Te 3/8" grove Sub Rad								
22— (SP) 23— 24—			Ó							
23+										
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PROJECT NO. 8911461

(9948)

SHEET 3 OF 7

Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POLL VES HOLE NOVESP-6C

	TWAR CP CONSTITUTION OF THE SECOND	GRAPH	IC LOG		<u> </u>	54	МР	LES	
DEPTH (FEET)	DESCRIPTION	Lithology	Plazometer Installation	Woter	Plezone	Type Ma.	Recor. (Panate Bloss Fig.	REMARKS (Drill Rele, Fluid loss, Odor, etc)
25-	Grovey Sond AS Above Grovel 10% ±								
27									·
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30 31	Grovel Size inch to maximum 1/2×34	0							
32		0							
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PROJECT NO. 89M 1146-1

(9948)

SHEET 4 OF 7

Woodward-Clyde Consultants PROJECT NAME RMA COE MOTOR POOL VES HOLE NO. VESP-60

		GRAPH	c roe	. =	2	54		LES	REMARKS
OEPTH (FEET)	DESCRIPTION	Lithology	C LOG Pleasmeter Installation	Wote Conte	Pierom Dofe	Type Na	Aecor.	Prost & Biore	(Drill Role, Fluid loss, Odor, etc.)
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40	Clay & Sondy, Clay &								
aí -	5hi plastic, Sand 1, Fg, TR grovel 1/8"	-/1				: : :			
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4 2-	(CL/ML)		·			-			
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PROJE	CT NO. <u>BDM114G1</u> (9948	3)	1					l <u></u>	SHEET 5 OF Z

Woodward-Clyde Consultants PROJECT NAME PMACOE MOTOR POOL VES HOLE NO. ESP-6C

	ward-Clyde Consultants PROJECT NAM	GRAPH	C TOE	-=				LES	
(reer)	DESCRIPTION	Lithology	Plezome ter metal lation	Conter	Piezome Date	Type No	Ascor. 1	Parette Belos Enos En	REMARKS (Drill Rule, Fluid loss, Odor, etc.
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Woodward-Clyde Consultants PROJECT NAME PHACOE MOTOR POLL VES HOLE NO. VESP-GC

-		GRAPH	c roe		į	\$4	MP	LES	
(reer)	DESCRIPTION	Lithology	Pleasometer Inetal lot los	Conten	Piezome Dafa	Type No.	Recor. ft	Penetra Resist Bloss 6 in)	REMARKS (Dritt Role, Fluid loss, Odor, etc.
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+	SAND, Clayey	. :/.			1		П		
Ţ	LI Yellow BRW	1]		П		
* ‡	F-Ca Sub 4-546 Rnd	٠, ٠							
1	SAND, Clayey LI Vellow BRW F-Cg Sub4-Sub Rnd Moist. Poor Graded	2			-	-			·
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PROJECT NO. 89M114G1

(9948)

SHEET 7 OF 7

ORING	RING LOCATIONS EC 4			- 1	LEVATION	N AN	D DAT	UM		•		
	is agency Layne Environmental	DRILLERD .	VERVE	15 0	DATE STARTED 6/12/91			10	-6/12/91			
RILLING	IG EQUIPMENT CHE 75			C	OMPLET				5'	SAMPLER		
PHLLIN	IG METHOD Elellow Stem auga	DRILL BIT	3"		NO. (ES	DIST.			UNDIST.		
	NO TYPE OF CASING /" School 40 P	vc			WATE.	R /.	FIRS	т		COMPL. 24 HRS.		
TYPE OF	F PEREDRATION I" PUC Factory Slats		TO /2		OGGED 14.W	. M	FRR	FL	4	CHECKED BY		
	NO TYPE OF PACK 20/40 Silice Seno		10/0	FT.	14100	, , - 4		_				
TYPE O	F SEAL Bentonite Chips	FROM 10	то /	FT								
FEET)	DESCRIPTION		Lithology	Plezona tratallel	stor a se	Plezometer Dote	4	न	Penetra Resist, 55 (Bibwe/ 6 in)	REMARKS (Drill Rate, Fluid toss, Odor, etc		
1 2 3 4 5	SAND, Cleyey, LT Yellow Ben Munsen 104R 4/4 F-Mgr., Subx-S Moist, Poorly Gre Fines 25% (SP)	iab Rnd Lod	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\									
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Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POULVES HOLE NO. VESP-7A

T		GRAPH		_	3	_	MP		
OFTER)	DESCRIPTION	Lithology	Pleasmeter tretoi lation	Water	Ple rome! Date	Type Ma.	Recor. ft	2 2 E	REMARICS (Drill Rate, Fluid loss, Odor, etc)
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RILLING EQUIPMENT CHE-75 RILLING EQUIPMENT CHE-75 RILLING METHOD FAILOW Stem Aug. DRILL BIT 8" NO. OF SAMPLER NO. OF SAMPLES IZE AND TYPE OF CASING 1" PUC School 40 WATER ELEV. PROM 46 TO 45 FT. WATER ELEV. CHECKED BY H. Merrell FROM 43 TO 38 FT. GRAPHIC LOG SAMPLES GRAPHIC LOG SAMPLES	DRING LO	erd-Clyde Consultants PROJECT			FLEV	A1 101		DAT	UM		
RILLING METHOD / COLON Stem Aug DRILL BIT 8" RILLING METHOD / COLON Stem Aug DRILL BIT 8" RILLING METHOD / COLON Stem Aug DRILL BIT 8" RILLING METHOD / COLON Stem Aug DRILL BIT 8" RILLING METHOD / COLON Stem Aug DRILL BIT 8" RILLING METHOD / COLON Stem Aug DRILL BIT 8" RILLING METHOD / COMPL. 124 HRS. RILLING METHOD / COMPL. 124 HRS. RILLING METHOD / COMPL. 124 HRS. RILLING METHOD / COMPL. 124 HRS. RILLING METHOD FIRST COMPL. 124 HRS. CHECKED BY			D. Werng		DATE	EMIS.	SHED	6	//	1/9	
SAMPLES CHECKED BY CHECKE	RILLING E	OUR MENT								8	
THE OF PERFORATION Factory Slots -020 FROM 46 TO 45 FT LOGGED BY VIPE OF PERFORATION Factory Slots -020 FROM 48 TO 43 FT LOGGED BY VIPE OF SEAL BOTTON FROM 48 TO 43 FT LOGGED BY VIPE OF SEAL BOTTON PACK O -40 Silect FROM 48 TO 35 FT LOGGED BY LITTLE OF SEAL BOTTON LITTLE DESCRIPTION DESCRIPTION LITTLE DESCRIPTION LITTLE DESCRIPTION PRINCE DESCRIPTION LITTLE DESCRIPTION LITTLE DESCRIPTION PRINCE DESCRIPT	RILLING	METHOD Hollow Stem Auga DRILL	*** 8"								
THE OF PERFORATION FRACTORY SLOTS DOES FROM 48 TO 43 FT. WE AND TYPE OF PACK AD-40 SILCE FROM 48 TO 43 FT. WE OF SEAL BOHDMITE CLIPS DESCRIPTION	IZE AND	TYPE OF CASING /11 PUC School 44)		W.	LEV.		FIRS	T		
THE AND TYPE OF PACK 20-40 Silice FROM 48 TO 43 FT. THE OF SEAL BEATONITE (), MS DESCRIPTION DESCRIPTION LITTLE OF PACK 20-40 Silice FROM 48 TO 43 FT. DESCRIPTION LITTLE OF SEAL BEATONITE (), MS DESCRIPTION LITTLE OF PACK 20-40 Silice FROM 48 TO 43 FT. PROM 43 TO 28 FT. REMARKS OF A BAND (Corper) LITTLE OF PACK 20-40 Silice FROM 48 TO 43 FT. REMARKS OF A BAND (Corper) REMARKS OF A BAND (Corper) LITTLE OF PACK 20-40 Silice FROM 48 TO 43 FT. REMARKS OF A BAND (Corper) REMARKS OF A BAND (Corper) LITTLE OF A BAND (Corper) REMARKS OF A BAND (YPE OF P	ERFORATION FORTON SINT 020 FROM	46 TO 45	FT.							CHECKED BY
DESCRIPTION DESCR	IZE AND	TYPE OF PACK AD - UD SILICE FROM			H.	Me	rre	2//			
DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION Lithology Placometer of the state of the sta	YPE OF S		43 TO ZO	FT							
Lithology Plasometry \$ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		DEPTONIC (KINS		ווכ ענ	× .		1	34	WPL	ES	
Sano, Clagey, LI Yellow BON [Munsoll) 104R 4/4 F-Mg, Sub K-Sib Rnd Pour Graded, Moist Trace finis , non-potstu	ĔΞ	NESCRIPTION	Lithology		restor	3 5	6.0	2	닭.	E # 8 E	
Trace finis pron-ploste	40	Jessen von		Inote	lation	*8	-	7	₹.	£ 25 •	(Drill Rets, Fluid toss, Odor, etc.)
Trace finis pron-plesty	-+						-		П		
Trace finis pron-ploste	Ŧ	SAND , Claver.					-		П		
Trace finis pron-ploste	+ ~		1		- 1		1	_	П		
Trace finis , non-ploste	Ŧ	LI YELLOW OUN						F			
Trace finis pron-plesty	Ŧ	Munsell 104R 4/4	- I/ ·				:	•			
Trace finis , non-plesty	1 +		1 1/2 .		1		-	-	П		
Trace finis pron-plesty	‡	F-Mg, Sub K- Jib Rn	d					t	$\ \ $		
Trace finis pron-plesty	‡	2011111111	``				-	Ł			
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PROJECT NO. WCC 89M11461 (9948)

SHEET___OF_6

Woodward-Clyde Consultants PROJECT NAME RAY COE Motor Pol VES HOLE NO. VESP-78

		GRAPH	C LOG	-	3	SA	MF	LES	
(FEET)	DESCRIPTION	Lithology	Plezometer testol let los	Water	Piezomei Dafa	Type No.	Recor. ft	Panate Regist Blows 6 h)	REMARKS (Drill Role, Fluid loss, Odor, etc)
7	As Asiar	· ·			4				
8	(SP)	`				-		į	·
9						-			
					1 1				
10+	SOUD LT-Yellow BED F-Mg Subx-Sub Rid	.,							
// -	Fines decr.	• ,			111111				
12+	SP)								
13		\ , '.							
#									
14									
15						1			
16		,				†			2 05

PROJECT NO. WCC 89M11461

(9948)

SHEET 2 OF 6

Woodward-Clyde Consultants PROJECT NAME RUA Motoe Pace VES HOLE NO. VESP-7B

8		Ward-Olyde Constitution Constitution	GRAPH	IC LOG		1		MF	LES	
	OEPTH (FEET)	DESCRIPTION	Lithology	Piesemeter Installation	Water	Pieromet Dote	Type Ma	Recor, (1	Penete Relat Blose 6 h)	REMARICS (Drill Rate, Fluid loss, Odor, etc)
	16-	-	, ,				-			
	•	SLUD LT VOILOW BRO	•		•		-			
		1								
	1-1-	M-Cg, Sub 4, -Sub and	./.				-			
	′′;	11 1 0 0 1	• •							
	-	SOND LT YELLOW BRD M-Cg, Sub x, Sub And Moist Poor Soul. Teace Grit 1/9-1/4" (1-2%) TR Fine's				-	-			
		Tooce Grit 1/9-1/4"	, .							
	18-	(1-2%)	٠.]	-			
		TR Fine's								
	-	SP)				1				
	19-	()	./				1			
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	2,-	‡					‡			
	43						1_	لـ		1 7 /

PROJECT NO. 89M114G1

(9948)

SHEET 3 OF 6

Woodward-Clyde Consultants PROJECT NAME BYA Mothe Pool VES HOLE NO. VESP-78

		GRAPH	C LOG	. =	}	SA	MP	LES	
(reer)	DESCRIPTION	Lithology	Pleasmeter Installation	Veter	Ple tome Date	Type No.	Aecor. f	A Balan	REMARKS (Drill Male, Field loss, Odor, etc)
25- 26-	SAND LTYELLOW BEN M-Cg, SubEnd Moist	() () () () () () () () () ()	·		1 1 1 1 1 1				
27	Some Grit 18-14" 10%= Sub RN (SP)								
28		5 ,			1 1	المستمالية			·
2 4-		. 0							
30-	As above Coverel incr to 15%								
31-	Hoist Par Soct								
32-	(Sp)	. 6			-	+ + + + + + + + + + + + + + + + + + + +			
34		0'				+ + + + + + + + + + + + + + + + + + + +			

PROJECT NO. 89M 11461

(9948)

SHEET 4 OF 6

Woodward-Clyde Consultants PROJECT NAME PHA Motor Fool VES HOLE NO

-	dward-Ciyde Colsularia Trioscol Inamo	CB48V	C 105			SA	MPL	FS	
OEPTH (FEET)	DESCRIPTION	GRAPH Lithology	Pleasmeter tretolistism	Tontent	Ple zomete Dofe	7 e 7	-1	A Color	REMARKS (Drill Rais, Fluid loss, Odor, etc)
34-	SAND, LI Yellow BED		,		++++++				
35	SAND, LT Yellow BED Poor SBADED. Mois! H-cg, Sub 4 - Sub End. 20% Fine Ground & Gr. +				***************************************				
36						-			
37	† - - - - - - -					-			
38.	† + + + + + + + +	• .				-			·
34-	+ + + + + + +	0.				-			
40	SAND, Cloudy SAND, Cloud BED					-			
41 .	F-Ma Sobx Moist, Poor Gradel		·						
42									
43	(SP)	(,			1				

Woodward-Ctycle Consultants & PROJECT NAME RIA MOTORFAL VES HOLE NO. VESP-78

	Wart-Crybe Consultants Trionson Manual	GRAPH		. =	<u>}</u>		MPLES	
OF (FEET)	DESCRIPTION	Lithology	Pleasometer metal lation	Conte	Piezome Dofe	Type R	Pecor.	REMARKS (Drill Rate, Fluid loss, Odor, etc)
45	As Dean	. /			+			
44	(sr)	\(\frac{1}{1}\)						
45	SAND É CLAY LIVETION BEN F-Mg							
46	Low Plastic, Mais 4				4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4			
47	CL/SP				1 1 1 1 1 1 1			
48-	7.0							
To a confluence								
1								
					-	+		

PROJECT NO. 89/11461

(9948)

SHEET 6 OF 6

Woodward-Clyde Consultants PROJECT NAME RMA COE Mater Pod & HOLE NO. VESP-7C WERNER LAYKE Environmental SAMPLER UNDIST. DRILLING METHOD HOLLOW Stern Chuger SIZE AND TYPE OF CASING IN PUC SO DRILL BIT WATER ELEV. CHECKED BY FROM 56 PVC School 40, HW. MERRELL Bantonite Chips DEPTH FEET) REMARKS

THE CONTROL FINIS SES, Odor, etc.) DESCRIPTION Cleyey Sand, LI Yellow Ben 1 = (Munsell) 104E 4/4 F-Mg, Sub 4-Sus Rus

Mast, non-plastic Poorly Graded, moist.

PROJECT NO. LOVE - 89M114-G1

(9948)

SHEET _ OF _ Z

/oodwa	ard-Ctyde Consultants	PROJECT NAME	M2	tse Pa	儿		15	S	HOLE	NO.VESP7
(FEET)	DESCRIPTION		GRAPH	C LOG Pleasmeter Installetion	Weter	Plettmeter Date	Type Ma	Panate Relate Blose	(Drill Med	REMARKS e, Fluid loss, Odor, eld
7	Clayer Sand	Ds Deoce	1/5							
‡	•		, (,		4	-			
3‡		SP				4				
1			, ,			4144	.			
7 🚦			• /			1111				
‡			,	1		1				
10	SAND, SLI	Claud.	, ,				-			
‡	LT Yellow BI	ev.	١.,							
// -	F-Cg (for	1/8" grains)	,			-	-			
‡	Sub & - Sib or Clay & Fries Re		1./			-	-			
12+	TUTACE	·	' '				<u> </u>			
‡	Poorly Graded,	, moist	, '			-	<u>‡</u>			
13 +	· ·	(SP)	, ,			-	‡			
-							 			
14						-	+			
1							+,			
15							+			
1				,			‡			
16+			//				+			
	NO. 89M114G1		(7948)					SHEET 2 OF

Woodward-Clyde Consultants	PROJECT NAME	Motor Pool	VES	HOLE NO. VESP-7C

	dward-ciyue consultanta	GRAPH	c roe	. =	3 -	SAM	PLES	REMARKS		
OEPTH (FEET)	DESCRIPTION	Lithology	Pleasmeter testel lot los	Wole. Conte	Piezome Date	Recor. f	2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(Drill Rule, Fluid loss, Odor, etc.)		
16		,/			+					
	Sour BS BROWE	V	,		1					
		- ,			1			į.		
17	Sc/sp	. ,			Ħ					
	‡				‡					
18					I					
	‡	- ,			‡					
	T	' '			‡					
19		/.			‡					
	‡ ‡				1					
20		(' -			‡					
	SAND LTYEllow BEN [Munsell) 104E 4/4 F-Cg 5% Fine Gowel (Girl)	1								
	+ () ((a ser) 10 y = 4/4	1								
21	F-Cg	, ,			‡	-				
	5% Fine Gorvel (Grit)	(‡	-				
	T .	1 ,								
22	Moist Poor Graded	,								
	\$ (SP)					-				
23		(,				-				
	<u>‡</u>					-,				
	1	,								
24	+	, ,								
	± ±					-				
24	1				1	_				

PROJECT NO. W.C. B9M114G1

(9948)

SHEET 3 OF 7

Woodward-Chyde Consultants PROJECT NAME Motor Pool VES HOLE NO. VESP-7C

		GRAPHI	_	SAMPLES						
OEPTH (FEET)	DESCRIPTION	Lithology	Pleasmeter metal lefter	Conten	Piezomei Dote	Type No.	Recor. (1	O DIE	REMARICS (Drill Role, Fluid loss, Odor, etc.)	
25	Saud AS ABOOD	('			4	-				
	DS A500		,		4	<u>-</u> -				
26	- -	,				-				
					4	• • •			·	
	(SP)					-				
27	·	٠,			1 1	-				
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20	-	- ,			1	ı a l a				
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		,								
29-	_	` .								
		, ,			1111					
30		e i			-					
	Shickyen	./								
21	SAND, Cleyey Lt yellow Ben				-					
P' 3	Maril Par Galal	`. <i>'</i> /								
	Morst, Pour Gradel	/ , '								
32-	FMg., TR Grit Size	, ,				-				
4	(SP)				-	ŧ,				
33 -		. ,			-	-				
		, .								
		1 /				-			_	
34-	t ect NO. <u>89M 114 G1</u> (9	948				上		<u> </u>	SHEET 4_ OF 7	

	Ward-Ciyue Constitution - Product Manual	GRAPH	ic Log	. =	<u>}</u>	SA	MPLES	
DEPTH (FEET)	DESCRIPTION	Lithology	Piezometer Installation	Water	Plezome Dafe	Type No.	Panete. ft	REMARKS (Ortil Mate, Fluid loss, Odor, etc)
34.		1			1	-		
		/1]			
					$\lfloor \frac{1}{4} \rfloor$			
36-		·]	-		
ا لا	SUND, SLI Cleyey							
	LTYELLOW BRN,	, ,				-		
-								
36-	Hon Nostic, Moist Lit Gut sired grains	/				-		
	NON JUSTIC , FIDIST	1.			4			
•	Lit Grit Situal grains							
37-	SP	- '			=			
	\sim \					-		
		-/				F		
38-								
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						-		
39 -		• ,			=			
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40-		ľ. ·			=	-		
		,						
		\`.			=			
					1 3	_		
H :								
	Sind LT Yellow Bolow M-cg, Sig 4-Sib Rnd, Hort	F			-	+,		
	M-Cg, Sug 4-Sub Rad Moist	1.						
42-	7		-			+		
	Clay, Plastic, moist					‡		
	Cubo 1048 4/4					‡		
43.	<u> </u>	-	1		-	+		
	DO MUATA	1040						SHEET & DE

Woodward-Clyde Consultants PROJECT NAME RYA COE Moto-Pod VES HOLE NO. VES-7C

		GRAPH		}	5/	MP	LES			
06)TH (FEET)	DESCRIPTION	Lithology	Plezometer metaliation	Weter	Piezome Dafa	Type No.	Recor, f	Panave Resist Blows 6 ft)	REMARKS (Drill Rule, Fluid loss, Odor, etc.)	
43-	SAND ÉCICY				4	-				
	as Above	, '				-				
	1	. ~								
44										
					1				·	
		- ÷]					
45-						-				
		-/			3					
46-	CLAY SOLT, SLI PlostEc, moist; Some Sond & SLT - 30%									
3	Hostec, moist; Some				-	-				
	Sond & SLT - 30%					•				
47-	(CL)									
					-	-				
48-	-									
	<u></u>	//			=	-				
		1/1			:	-	١			
49-	-	//				F				
-					-	+				
4.	+	,				E				
50-	SAMO LT Yellow BEU	٠ - ,								
-	F-Mg MOIST				-	+				
	TR GEIT SIZED gri	, ,				_				
51-						‡				
٩.	Clogey (Sp)				-	+				
A7		. ,			.	‡				
52	FCT NO 8914 114G1 (9948	1	1_	1_			1	SHEET 6 OF	

PROJECT NO. 89/4/1461

(9948)

SHEET 6 OF Z

Woodward-Clyde Consultants PROJECT NAME RHA COE Motor Pool VES HOLE NO. VESP-7C

		GRAPH		. =	E	SA	MPLES			
0E PTH (FE ET)	DESCRIPTION	Lithology	Plezometer Installetion	Conten	Ple rome Date	Type No.	Panette. ft	REMARICS (Orill Rele, Fleid loss, Odor, etc)		
1	SAND LT Yellow BROWN Munsell 104R 4/4 F-M-grained, Sub4, Sub Run Moist, Poor Gradeb TR Sines		·							
54	Moist, Paor Gradelo TR Sines (SP)									
55		·/,								
56-										
57										
59	TiD 58'				leer leer l	Landanal				

PROJECT NO. 89M11461

(9948)

SHEET ZOFZ

APPENDIX B ANALYTICAL CHEMISTRY RESULTS



Form ARP-AL

Page 1 of

Part 1 of

ate	7/29/	n Number 91-1959	-
-		I Mambet 31-1478	
Account No	o. <u>03019</u>		

Voodward-Clyde Consultants 4582 South Ulster Street Parkway Standford Place 3, Suite 1000 Denver, CO 80237 Attention: Jeff Cox

Telephone (303) 740-2791

Sampling Collection and Shipment

Sampling Site _____ Date of Collection

_ Date of Collection July 16, 1991

Date Samples Received at DataChem July 22, 1991

Analysis

Method of Analysis GC/FID

Date(s) of Analysis July 24, 1991

Analytical Results

Field Supple			chloro glene sample scrion	chloro Miene semple section			:		
			Tri	Trich thyl 18/38					
VESP5A071691	CL 14995	CT	0.05	ND*					
VESP5B071691	CL 14996	CT	0.14	ND*					1
VESP5C071691	CL 14997	CT	0.16	ND*		· · · · · · · · · · · · · · · · · · ·			1
UESP6A071691	CL 14998	CT	0.13	ND*					H
VESP6B071691	CL 14999	CT	0.17	ND*					Η-
VESP6C071691	CL 15000	CT	0.12	ND.			-		+
VESP7A071691	CL 15001	СТ	0.23	ND*					╫╌
VESP78071691	CL 15002	CT	0.21	ND*				 	H-
VESP7C071691	CL 15003	CT	0.17	ND*			<u> </u>	 	╫╴
VESP8A071691	CL 15004	CI	0.09	MD*			i_	 	₩-
VESP88071691	CL 15005	CT	0.09	MD*					#-
VESP8 C071691	CL 15006	CT	0.02	MD.					╫╴
VES-1000-P	CL 15007	CT	0.22	ND*					#-

See comment on last page.

ND Parameter not detected.

R Parameter not requested.

() Parameter between LOD and LOQ

Analyst: Amy Je Jenson

Reviewed: Pinela Johnson

Laboratory Supervisor: Daniel J. Bruch

960 West Levoy Drive / Salt Lake City, Utah 84123-2547 / (801) 266-7700 A Sorenson Company



Form ARF-BL

Page 2 of

Part 1 of

Date 7/29/91
Agency Identification Number 91-1959

Analytical Results

VESP58071791 CL 15010	mining (1Ch)	ACCIONATED					 		1	
NEST-1001 CL 15008 CT	**************************************				Trichloro ethylene mg/sample 'B' SECTION					
VESPSB071791 CL 15010 CT 0.06 MD* VESPSB071791 CL 15011 CT ND* MD* VESPSB071791 CL 15012 CT 0.11 MD* VESPSB071791 CL 15013 CT 0.06 MD* VESPSB071791 CL 15013 CT 0.07 MD* VESPSB071791 CL 15015 CT 0.07 MD* VESPSB071791 CL 15016 CT 0.07 MD* VESPSB071791 CL 15016 CT 0.00 MD* VESPSB071791 CL 15017 CT ND* MD* VESPSB071791 CL 15018 CT 0.02 MD* VESPSB071791 CL 15019 CT 0.02 MD* VESPSB071791 CL 15010 CT 0.01 MD* VESPSB071791 CL 15010 CT 0.01 MD* VESPSB071791 CL 15010 CT 0.02 MD* VESPSB071791 CL 15010 CT 0.01 MD* VESPSB071791 CL 15010 CT 0.01 MD* VESPSB071791 CL 15010 CT 0.25 MD* VESPSB071791 CL 15010 CT 0.26 ND* VESPSB071791 CL 15010 CT 0.26 ND* VESPSB071791 CL 15022 CT MD* ND* VESPSB071791 CL 15025 CT 0.26 ND* VESPSB071791 CL 15025 CT 0.28 ND* VESPSB071791 CL 15026 CT 0.19 ND* VESPSB071791 CL 15028 CT 0.21 ND* VESPSB071791 CL 15029 CT 0.19 ND* VESPSB071791 CL 15029 CT 0.19 ND* VESPSB071791 CL 15029 CT 0.19 ND* VESPSB071791 CL 15029 CT 0.19 ND* VESPSB071791 CL 15031 CT 0.21 MD* VESPSB071791 CL 15031 CT 0.22 MD* VESPSB071791 CL 15031 CT 0.23 MD* VESPSB071791 CL 15031 CT ND* ND* VESPSB071791 CL 15031 CT ND* ND* VESPSB071791 CL 15031 CT ND* ND* VESPSB071791 CL 15031 CT ND* ND* VESPSB071791 CL 15031 CT ND* ND* VESPSB071791 CL 15031 CT ND* ND* VESPSB071791 CL 15031 CT ND* ND* VESPSB071791 CL 15031 CT ND* ND* VESPSB071791 CL 15031 CT ND* ND* VESPSB071791 CL 15031 CT ND* ND* VESPSB071791 CL 15031 CT	VES-1001	CL 15008	CT	ND*						T
VESP5CO71791 CL 15011 CT ND* ND* ND* VESP6A071791 CL 15012 CT 0.11 ND* VESP6A071791 CL 15013 CT 0.06 ND* VESP6A071791 CL 15015 CT 0.07 ND* ND* VESP7A071791 CL 15015 CT 0.07 ND* ND* VESP8A071791 CL 15016 CT 0.10 ND* VESP8A071791 CL 15018 CT 0.02 ND* VESP8A071791 CL 15018 CT 0.02 ND* VESP8A071791 CL 15019 CT 0.02 ND* VESP8A071791 CL 15010 CT 0.01 ND* ND* VESP8A071791 CL 15010 CT 0.01 ND* ND* VESP8A071791 CL 15010 CT 0.02 ND* VESP8A071791 CL 15010 CT 0.02 ND* ND* VESP8A071791 CL 15010 CT 0.05 ND* VESP8A071791 CL 15010 CT 0.05 ND* VESP8A071791 CL 15010 CT 0.05 ND* VESP5A071791 CL 15010 CT 0.25 ND* ND* VESP5A071791 CL 15010 CT 0.25 ND* ND* VESP5A071791 CL 15010 CT 0.05 ND* VESP5A071791 CL 15010 CT 0.05 ND* VESP5A071791 CL 15020 CT 0.05 ND* VESP5A071791 CL 15020 CT 0.05 ND* VESP5A071791 CL 15020 CT 0.19 ND* VESP5A071791 CL 15020 CT 0.19 ND* VESP5A071791 CL 15020 CT 0.19 ND* VESP5A071791 CL 15020 CT 0.19 ND* VESP5A071791 CL 15020 CT 0.19 ND* VESP5A071791 CL 15020 CT 0.19 ND* VESP5A071791 CL 15020 CT 0.23 ND* VESP5A071791 CL 15020 CT 0.20 ND* ND* VESP5A071791 CL 15020 CT 0.20 ND* ND* VESP5A071791 CL 15020 CT 0.23 ND* ND* VESP5A071791 CL 15020 CT 0.23 ND* ND* VESP5A071791 CL 15020 CT 0.23 ND* ND* ND* VESP5A071791 CL 15021 CT 0.24 ND* ND* ND* VESP5A071791 CL 15030 CT 0.24 MD* ND* ND* VESP5A071791 CL 15031 CT ND* ND* ND* ND* VESP5A071791 CL 15031 CT ND* ND* ND* ND* VESP5A071791 CL 15030 CT 0.24 MD* ND* ND* ND* ND* ND* ND* ND* ND* ND* N	VESP5A071791	CL 15009	CI	0.22	ND*					T
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UESP78071791 CL 15015	VESP6B071791	CL 15013	CT	0.06	MD*					\mathbf{L}
VESP3B071791 CL 15016 CT ND* ND*	VERP6C071791	CL 15014	CT	ND*	MD.					
VESPBO71991 CL 15037 CT ND* ND* ND* VESPBO71991 CL 15030 CT 0.05 ND* VESPBO71991 CL 15028 CT 0.06 ND* VESPBO71991 CL 15028 CT 0.19 ND* VESPBO71991 CL 15028 CT 0.19 ND* VESPBO71991 CL 15028 CT 0.19 ND* VESPBO71991 CL 15028 CT 0.19 ND* VESPBO71991 CL 15028 CT 0.19 ND* VESPBO71991 CL 15028 CT 0.19 ND* VESPBO71991 CL 15028 CT 0.19 ND* VESPBO71991 CL 15030 CT 0.21 ND* ND* VESPBO71991 CL 15030 CT 0.22 ND* VESPBO71991 CL 15030 CT 0.23 ND* VESPBO71991 CL 15030 CT 0.24 ND* ND* VESPBO71991 CL 15030 CT 0.23 ND* VESPBO71991 CL 15030 CT 0.24 ND* ND* VESPBO71991 CL 15030 CT 0.24 ND* ND* VESPBO71991 CL 15030 CT 0.24 ND* ND* VESPBO71991 CL 15030 CT 0.24 ND* ND* VESPBO71991 CL 15030 CT 0.24 ND* ND* VESPBO71991 CL 15030 CT 0.24 ND* ND* VESPBO71991 CL 15030 CT 0.21 ND* ND* VESPBO71991 CL 15030 CT 0.11 ND* ND* VESPBO71991 CL 15030 CT 0.11 ND* ND* VESPBO71991 CL 15030 CT 0.11 ND* ND* VESPBO71991 CL 15030 CT 0.11 ND* ND* VESPBO71991 CL 15030 CT 0.11 ND* ND* VESPBO71991 CL 15030 CT 0.11 ND* ND* VESPBO71991 CL 15030 CT 0.11 ND* ND* ND* VESPBO71991 CL 15030 CT 0.11 ND* ND* ND* VESPBO71991 CL 15030 CT 0.11 ND* ND* ND* ND* ND* ND* ND* ND* ND* ND*	VESP7A071791	CL 15015	CI	0.07	ND.					
VESPBRO71791 CL 15018	UESP78071791	CL 15016	CT	0.10	MD.					
VESPBB071991 CL 15032	VESP7C071791	CL 15017	CT	ND*	ND*					
VESPACO71791 CL 15020 CT 0.01 MD* VESCH3071791 CL 15021 CT 0.25 MD* VESCH3071791 CL 15022 CT MD* MD* VESCH3003 CL 15023 CT 0.26 MD* VESCH3003 CL 15024 CT MD* MD* VESCH3003 CL 15025 CT 0.05 MD* VESCH3071991 CL 15025 CT 0.05 MD* VESCH3071991 CL 15026 CT 0.19 MD* VESCH3071991 CL 15027 CT 0.22 MD* VESCH3071991 CL 15028 CT 0.06 MD* VESCH3071991 CL 15029 CT 0.19 MD* VESCH3071991 CL 15031 CT MD* MD* VESCH3071991 CL 15032 CT 0.23 MD* VESCH3071991 CL 15033 CT 0.24 MD* VESCH3071991 CL 15033 CT 0.24 MD* VESCH3071991 CL 15033 CT 0.24 MD* VESCH3071991 CL 15036 CT 0.11 MD* VESCH3071991 CL 15036 CT 0.11 MD* VESCH3071991 CL 15036 CT 0.11 MD* VESCH3071991 CL 15037 CT ND* MD*	VESP8A071791	CL 15018	CT	0.02	ND*					
VES-3-071791 CL 15021	VESP89071791	CL 15019	CT	0.02	ND.					
VESDISO71791 CL 15022 CT ND* ND* ND* VESP5A071991 CL 15028 CT 0.26 ND* VESP6A071991 CL 15030 CT 0.27 ND* VESP6A071991 CL 15030 CT 0.28 ND* VESP6A071991 CL 15030 CT 0.29 ND* VESP6A071991 CL 15030 CT 0.25 ND* VESP6A071991 CL 15030 CT 0.25 ND* VESP6A071991 CL 15030 CT 0.25 ND* VESP6A071991 CL 15030 CT 0.25 ND* VESP6A071991 CL 15030 CT 0.25 ND* VESP6A071991 CL 15030 CT 0.25 ND* VESP6A071991 CL 15030 CT 0.24 ND* VESP7A071991 CL 15030 CT 0.24 ND* VESP7A071991 CL 15030 CT 0.24 ND* VESP7A071991 CL 15030 CT 0.24 ND* ND* VESP7A071991 CL 15030 CT 0.24 ND* ND* VESP7A071991 CL 15030 CT 0.24 ND* ND* VESP7A071991 CL 15030 CT 0.24 ND* ND* VESP7A071991 CL 15030 CT 0.24 ND* ND* ND* VESP7A071991 CL 15030 CT 0.24 ND* ND* ND* ND* ND* ND* ND* ND* ND* ND*	VESP8C071791	CL 15020	CT	0.01	ND.					
VES-1003	VES-3-071791	CL 15021	CT	0.25	ND*					
VES-1003 CL 15024 CT	VBSDIS071791	CL 15022	CT.	ND+	ND*					
VESP5A071991 CL 15025 CT 0.05 ND* VESP5B071991 CL 15026 CT 0.19 ND* VESP6A071991 CL 15028 CT 0.06 ND* VESP6B071991 CL 15029 CT 0.19 ND* VESP6C071991 CL 15030 CT 0.25 ND* VESP7A071991 CL 15031 CT ND* ND* VESP7B071991 CL 15032 CT 0.23 ND* VESP7C071991 CL 15033 CT 0.24 ND* VESP8B071991 CL 15034 CT ND* ND* VESP8B071991 CL 15035 CT 0.11 ND* VESP8B071991 CL 15036 CT 0.11 ND* VESP8C071991 CL 15037 CT ND* ND*	VES-1002-P	CL 15023	CT	0.26	ND*					T
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VESP68071991 CL 15028 CT 0.06 ND* VESP68071991 CL 15029 CT 0.19 ND* VESP6C071991 CL 15030 CT 0.25 ND* VESP7N071991 CL 15031 CT ND* ND* VESP7B071991 CL 15032 CT 0.23 ND* VESP7C071991 CL 15033 CT 0.24 ND* VESP8A071991 CL 15034 CT ND* ND* VESP8B071991 CL 15035 CT 0.11 ND* VESP8C071991 CL 15036 CT 0.11 ND* VESP8C071991 CL 15037 CT ND* ND*	VESP5B071991	CL 15026	CT	0.19	ND*			:		
VESP6B071991 CL 15029 CT 0.19 ND* VESP6C071991 CL 15030 CT 0.25 ND* VESP7A071991 CL 15031 CT ND* ND* VESP7B071991 CL 15032 CT 0.23 ND* VESP7C071991 CL 15033 CT 0.24 ND* VESP8A071991 CL 15034 CT ND* ND* VESP8B071991 CL 15035 CT 0.11 ND* VESP8C071991 CL 15036 CT 0.11 ND* VESD35071991 CL 15037 CT ND* ND*	VESP5C071991	CL 15027	CT	0.22	ND*					
VESP6C071991 CL 15030	VESP6A071991	CL 15028	CT	0.06	ND*					
VESP7B071991 CL 15031	VESP6B071991	CL 15029	CI	0.19	ND*					
VESP7B071991 CL 15032	VESP6C071991	CL 15030	C7	0.25	ND*					
VESP7C071991 CL 15033	VESP7A071991	CL 15031	CT	ND.	ND.					
VESP8A071991 CL 15034	VESP78071991	CL 15032	CT.	0.23	ND*					
VESP88071991 CL 15035	VESP7C071991	CL 15033	CT	0.24	MD.					
VESP8C071991 CL 15036 CT 0.11 MD*	VESP8A071991	CL 15034	CI	ND*	ND.					
VESDES071991 CL 15037 CT ND* ND*	VESP88071991	CL 15035	CT	0.11	MD.					
	VESP8C071991	CL 15036	CT	0.11	ND*					
* See compart on lock news			CT	ND*	ND.					Н

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^{**} See comment on last page.

() Parameter between LOD and LOQ.



Form ARF-BL

Page 3 of

Part 1 of

Date 7/29/91
Agency Identification Number 91-1959

Analytical Results

Analy tical										
			Trichloro ethylene eg/sample 'A' SECTION	Trichloro ethylene mg/sample 'B' SECTION						
VES-3-071991	CL 15038	CT	0.16	MD*						П
VES-1004-P	CL 15039	CT	0.15	HD.						
VES-1005	CL 15040	CT	ND*	ND*	L					
TRIP BLANK	CL 15041	CT	ND.	ND*						П
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() Parameter between LoD and Log.

960 West LeVoy Drive / Salt Lake City, Utah 84123-2547 / (801) 266-7700 A Sorenson Company



AUG 1 2 1991

Form ARF-AL

1 of2 Page of Part 1

WOO/DENVER, COLORADO

Date _	9/9/71	_
	Identification Number 91-2024	_
•	No. 03019	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Standford Place 3, Suite 1000 Denver, CO 80237 Attention: Jeff Cox

FAX		
Telephone	(303)	740-2791

Sampling	Collection and Shipment Sampling Site Date of Collection July 24, 1991
	Date Samples Received at DataChem <u>July 26, 1991</u>
Analysis	Method of Analysis NIOSH 1022 Date(s) of Analysis July 31, 1991

Analytical	Results				1	1]
rield Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE A SECTION	Trichloro ethylene MG/SAMPLE B SECTION					
VES5A072491P	CL 15626	CT	0.01	ND*					-
VES5B072491P		CT	0.03	ND*					┨.
VES5C072491P		CT	0.07	ND*					-
VES6A072491P	CL 15629	CT	0.03	ND*	·				
VES6B072491F	CL 15630	CT	0.07	ND*					-
VES6C072491F		СТ	0.19	ND*		_	<u> </u>		-
VES7A072491E		CT	ND*	ND+			 	-	
VES7B072491F	CL 15633	CT	0.14	ND*			 		.
VES7C0724911	CL 15634	CT	0.08	ND*					
VES8A0724911	CL 15635	CT	ND*	ND*					-
VES8B0724911	CL 15636	CT	0.04	ND*			-	-	
VES8C0724911	CL 15637	CT	ND*	ND*					
VES3072491P		CT	0.10	ND*					

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ND Parameter not detected.
NR Parameter not requested.

** See comment on last page.
() Parameter between LOD and LOQ.



Form ARF-BL

Page

2 of 2

Part 1 of

Agency Identification Number 91-2024

Analytical	Results
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Results										
DetnChem Lab Bumber	Sanple Lyp.	Trichloro ethylene mg/Sample A Section	Trichloro ethylene MG/SAMPLE B SECTION							_
CL 15639	CT	ND*	ND*							
CL 15640	CT	0.08	ND*							
CL 15641	CT	ND*	ND*							
CL 15642	CT	ND*	ND*							
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	DataChem Lab Bumber CL 15639 CL 15640 CL 15641 CL 15642	DetaChem Sample Type Lab Sumber Type CL 15639 CT CL 15640 CT CL 15641 CT CL 15642 CT	DataChem Lab Sample Close Type Class Manuel Class Control	DetaChem Sample Order Manager Type Order Manager Type Order Manager Type Order Manager	DetaChem Sample Lab Zype Pumber Zype Use I Season CT ND* ND* CL 15640 CT ND* ND* CL 15641 CT ND* ND* CL 15642 CT ND* ND* etection O.01 C.01	Detachem Sample	DataChem Lab Lab Type	DataChem Lab Flab Flab Flab Flab Flab Flab Flab Fl	Detachem Sample Code Code Code Code Code Code Code Cod	DetaChem Sample Cody Cod

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ANALONICAL REPORT

AUG 2 8 1991

Page 1 of Part of

WCC/DENVER, COLORADO

Date	8/23/91	
Agency Iden	tification Number 91-2162	
Account No.	03019	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Standford Place 3, Suite 1000 Denver, CO 80237 Attention: Jeff Cox

FAX		
Telephone	(303)	740-2791

Sampling (Collection and Snipment
	Sampling Site Date of Collection July 29, 1991
	Date Samples Received at DataChem August 06, 1991
Analysis	
	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022
	Date(s) of Analysis August 15, 1991

Analytical Results

Field Sample Number	DataChen Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethene mg/sample GC/FID	vinyl Chlorid mg/sample GC/FID	
5A-072991-P	CL 17099	CT	ND*	ND*	ND*	
5B-072991-P	CL 17100	CT	0.02	ND*	ND*	Wed co
5C-072991-P	CL 17101	CT	ND*	ND*	ND*	L VV CO
5A-072991-P	CL 17102	CT	0.01	ND*	ND*	
6B-072991-P	CL 17103	CT	0.03	ND*	ND*	
6C-072991-P	CL 17104	CT	0.02	ND*	ND*	
7A-072991-P	CL 17105	CT	ND*	ND*	ND*	
7B-072991-P	CL 17106	CT	0.03	ND*	ND*	
7C-072991-P	CL 17107	CT	0.02	ND*	ND*	AZ
8A-072991-P	CL 17108	CT	ND*	ND*	ND*	1 to 19 their code
8B-072991-P	CL 17109	CT	0.03	ND*	ND*	
8C-072991-P	CL 17110	CT	ND*	ND*	ND*	
DIS-072991-F	CL 17111	CT	ND*	ND*	ND*	

ND Parameter not detected. NR Parameter not requested.



Form ARF-BL

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Part 1 of 1

Date	3	123/	101
	Identific	ation	Number 91-2162

Analytical Results

rield Sample Number	DataChem Lab Bumber	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethene mg/sample GC/FID	Vinyl Chloride mg/sample GC/FID				
VES4072991-P	CL 17112	СТ	0.17	ND*	ND*				$oxed{oxed}$
VES-2000-P	CL 17113	CT	ND*	ND*	ND*			<u> </u>	$oldsymbol{\perp}$
VES-2001	CL 17114	CT	ND*	ND*	ND*				$oxed{\bot}$
5A-073191-P	CL 17115	СТ	ND*	ND*	ND*				_
5B-073191-P	CL 17116	CT	0.01	.ND*	ND*				L
5C-073191-P	CL 17117	СТ	0.04	ND*	ND*				上
6A-073191-P	CL 17118	CT	ND*	ND*	ND*				\perp
6B-073191-P	CL 17119	CT	0.02	ND*	ND*				\perp
6C-073191-P	CL 17120	CT	ND*	ND*	ND*			<u> </u>	\perp
7A-073191-P	CL 17121	CT	ND*	ND*	ND*				1_
073191-P	CL 17122	СТ	ND*	ND*	ND*			 	. _
7C-073191-P	CL 17123	CT	0.03	ND*	ND*			 	↓_
6A-073191-P	CL 17124	СТ	ND*	ND*	ND*				\downarrow
8B-073191-P	CL 17125	CT	0.03	ND*	ND*				╀
8C-073191-P	CL 17126	CT	0.03	ND*	ND*				╀
DIS-073191-E	CL 17127	CT	ND*	ND*	ND*				L
VES4073191-I	CL 17128	СТ	0.19	ND*	ND*		-		\perp
VES-2002-P	CL 17129	CT	0.03	ND*	ND*				_
VES-2003	CL 17130	CT	ND*	ND*	ND*				1
5A-080291-P	CL 17131	CT	ND*	ND*	ND*			 	\bot
5B-080291-P	CL 17132	CT	ND*	ND*	ND*				╽-
5C-080291-P	CL 17133	CT	0.01	ND*	ND*				1
6A-080291-P	CL 17134	СТ	ND*	ND*	ND*				\perp
6B-080291-P	CL 17135	СТ	0.02	ND*	ND*				†
6C-080291-P	CL 17136	СТ	0.02	ND*	ND*				1
7A-080291-P	CL 17137	СТ	ND*	ND*	ND*				-
7B-080291-P	CL 17138	CT	ND*	ND*	ND*				1
7C-080291-P	CL 17139	CT	0.02	ND*	ND*				1
8A-080291-P	CL 17140	CT	ND*	ND*	ND*				
8B-080291-P		СТ	0.03	ND*	ND*				



Form ARF-BL

Page 3 of 4 Part 1 of 1

Nate 8/73/01

Field Sample						i i	-	1			
Number	DataChen Lab Number	Jacobio Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethene mg/sample GC/FID	vinyl Chloride mg/sample GC/FID			·			
C-080291-P	CL 17142	CT	ND*	ND*	ND*						L
ES-2004-P	CL 17143	CT	0.02	ND*	ND*						L
ES4080291-P	CL 17144	CT	0.13	ND*	ND*						ļ
IS-080291-P	CL 17145	CT	ND*	ND*	ND*						1
ES-2005	CL 17146	CT	ND*	ND*	ND*						Į.
RIP BLANK	CL 17147	СТ	ND*	ND*	ND*						1
Limit of D	etection		9,01	0.01	0.001						Ŧ
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Form ARF-C Page 4 of 4

Date	8/23/91	
	Identification Number 91-2162	

Sample Comments

DataChem Lab Number

-- Comment --

CL 17135

B-SECTION CONTAINED >30% OF REPORTED AMOUNT OF TRICHLOROETHYLENE.



Form ARF-AL

AUG 2 8 1991

Page 1 of 2 Part 1 of 1

WCC/DENVER, COLORADO

Date	8/23/91	
Agency	Identification Number 91-2217	
•	t No. 03019	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX Telephone (303) 694-2770

Sampling C	Collection and Shipment Sampling Site Date of Collection August 07, 1991
	Date Samples Received at DataChem August 09, 1991
Analysis	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022
	Date(s) of Analysis August 16, 1991

Analytical Results

Analytical	Results						 	T	7
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethene mg/sample GC/FID	Vinyl Chloride mg/sample GC/FID		-		
VES5A080791P	CL 17746	CT	ND*	ND*	ND*				1_
VES5B080791P	CL 17747	CT	ND*	ND*	ND*			-	4_
VES5C080791P	CL 17748	CT	0.01	ND*	ND*				_
VES6A080791P	CL 17749	CT	ND*	ND*	ND*			ļ	┨_
VES6B080791F	CL 17750	CT	0.02	ND*	ND*			 	4_
VES6C080791F	CL 17751	CT	0.02	ND*	ND*			 <u> </u>	
VES7A080791F	CL 17752	CT	ND*	ND*	ND*				. _
VES7B080791F	CL 17753	CT	ND*	ND*	ND*				1_
VES7C080791	CL 17754	CT	0.02	ND*	ND*				\perp
VES8A080791F	CL 17755	CT	ND*	ND*	ND*	<u> </u>			1
VES8B080791	CL 17756	CT	0.04	ND*	ND*			 	
VES8C0807911	CL 17757	CT	0.11	ND*	ND*				_
VES4080791-E	CL 17758	CT	0.08	ND*	ND*				L

See comment on last page.

ND Parameter not detected.

NR Parameter not requested.

** See comment on last page.
() Parameter between LOT and LOQ.

Analyst: Jeff R. Scott

Reviewer: Fred M. Rejali

Laboratory Supervisor: Daniel J. Bruch

960 West LeVoy Drive / Salt Lake City, Utah 84123-2547 / (801) 266-7700 A Sorenson Company



Form ARF-BL

2 of Page

of 1 1 Part

Date	9	172/	7/	
	Identifi	cation	Number	91-2217

Analytical	Results								ı
rield Sample Sumber	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethene mg/sample GC/FID	Vinyl Chloride mg/sample GC/FID				
VESDIS080791	CL 17759	CT	ND*	ND*	ND*				
VES-2006-P	CL 17760	CT	ND*	ND*	ND*		 		-
VES-2007-P	CL 17761	CT	ND*	ND*	ND*				\vdash
TRIP BLANK	CL 17762	СТ	ND*	ND*	ND*				
· Limit of D	etection		0,01	8,01	0.001				
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		+	+						1-
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Form ARF-AL

Page

1 of 1 of Part

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WCC/DENVER, COLORADO Date

Agency Identification Number 91

Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX Telephone (303) 694-2770

Sampling	Collection	and Snipment
	Sampling	Site

Date of Collection August 12, 1991

Date Samples Received at DataChem August 14, 1991

Analysis

Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022

Date(s) of Analysis August 26, 1991

Analytical Results

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethylene mg/sample GC/FID	Vinyl Chloride mg/sample GC/FID			,		
VES5A081291P	CL 18144	CT	ND*	ND*	ND*					+
VE55B081291P	CL 18145	CT	ND*	ND*	ND*					+
VES5C081291P	CL 18146	CT	0.04	ND*	ND*					+
VES6A081291P	CL 18147	CT	ND*	ND*	ND*		 			+-
VES6B081291P		CT	ND*	ND*	ND*				1	+-
VES6C081291F	CL 18149	CT	ND*	ND*	ND*					╀
VES7A081291F	T	CT	ND*	ND*	ND*					+
VES7B081291F		CT	ND*	ND*	ND*					\perp
VES7C081291F		CT	ND*	ND*	ND*					\bot
VES8A081291F		CT	ND*	ND*	ND*					_
VES8B081291F		CT	ND*	ND*	ND*	 !	 	·		+
VES8C081291		CT	0.03	ND*	ND*	 	 			+
DIS-081291-I		СТ	ND+	ND*	nd.					

See comment on last page. ND Parameter not detected. NR Parameter not requested.

** See comment on last page.
() Parameter between LOD and LOQ.



Form ARF-BL

2 of 2 Page of 1 Part 1

Date _ Agency Identification Number 91-2499

Analytical	Results										1
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethylene mg/sample GC/FID	vinyl Chloride mg/sample GC/FID						
VES3081291P	CL 18157	CT	0.05	ND*	ND*						+
VES-3000-P	CL 18158	СТ	ND*	ND*	ND*						+
VES-3001	CL 18159	СТ	ND*	ND*	ND*			<u> </u>			+
TRIP BLANK	CL 18160	СТ	ND*	ND*	ND*						+
* Limit of D	etection		0.01	0.01	0.001						+
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^{**} See comment on last page.
() Parameter between LOD and LOQ.



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Form ARF-AL

1 Page

of 1 of Part

Agency Identification Number 91-2630

Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000

Denver, CO 80237

Attention: Rich Scheig

FAX			
Telephone	(303)	694-2770	

Sampling	Collection and Shipment Sampling Site Date of Collection August 19, 1991
	Date Samples Received at DataChem <u>August 26, 1991</u>
Analysis	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022
	Date(s) of Analysis August 30, 1991

Analytical Results

Analytical	Kesults							i	1	٦
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID					
5A-081991-P	CL 19351	CT	ND*	ND*	ND*		ļ		ļ	┼
	CL 19352	CT	0.01	ND*	ND*				-	+-
5c-081991-P	CL 19353	CT	ND*	ND*	ND*	ļ				+-
6A-081991-P	CL 19354	CT	ND*	ND*	ND*				 	+-
6B-081991-P	CL 19355	CT	0.01	ND*	ND*					+
6C-081991-P	CL 19356	CT	0.04	ND*	ND*		<u> </u>			+-
7A-081991-P	CL 19357	CT	ND*	ND*	ND*			 		+-
7B-081991-F		CT	0.03	ND*	ND*					
7C-081991-P	CL 19359	CT	0.03	ND*	ND*					+
8A-081991-P	CL 19360	CT	ND*	ND*	ND*	-		 		+
8B-081991-P		CT	0.01	ND*	ND*					-
8C-081991-F		CT	0.03	ND*	ND*					+
VES3081991F		CT	0.05	ND*	ND*					丄

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^{**} See comment on last page.
() Parameter between LOD and LOQ.



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Agency Identification Number 91-2630

Analytical	Results									
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID				·	
DIS-081991-P	CL 19364	CT	ND*	ND*	ир*					
VES-3002-P	CL 19365	CT	ND*	ND*	ND*					
VES-3003	CL 19366	СТ	ND*	ND*	ND*					
TRIP BLANK	CL 19367	CT	ND*	ND*	ND*					
* Limit of D			0.01	0.01	0.001				a The a Media a Co	
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() Parameter between LOD and LOQ.



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Page 1 of 2 Part 1 of 1

Date 9/17/01
Agency Identification Number 91-2715
Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX Telephone (303) 694-2770

Sampling	Collection and Shipment	
	Sampling Site Date of Collection August 26, 1991	
	Date Samples Received at DataChem <u>September 03, 1991</u>	
Analysis		
imaryoro	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022	

Date(s) of Analysis September 12, 1991

Analytical Results

Ana	lytical	Results					,				,
Sa	eld mple mber	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID		·			
VES5A	A082691P	CL 20127	CT	ND*	ND*	ND*					L
VES5E	3082691P	CL 20128	CT	0.03	ND*	ND*					<u> </u>
VES50	082691P	CL 20129	CT	0.01	ND*	ND*					<u> </u>
VES6A	A082691P	CL 20130	CT	ND*	ND*	ND*					<u> </u>
VES6E	3082691P	CL 20131	CT	0.02	ND*	ND*					L.
		CL 20132	CT	ND*	ND*	ND*					ļ
VES7	A082691P	CL 20133	CT	ND*	ND*	ND*				1	L
VES7	3082691P	CL 20134	CT	0.02	ND*	ND*					1_
VES7	082691P	CL 20135	CT	ND*	ND*	ND*					L
VES8	A082691P	CL 20136	CT	ND*	ND*	ND*				!	_
VES8E	B082691P	CL 20137	CT	0.02	ND*	ND*		!	!	!	_
VES80	082691P	CL 20138	CT	ND*	ND*	ND*	!				_
VES30	082691P	CL 20139	CT	0.05	ND*	ND+					$oldsymbol{ol}}}}}}}}}}}}}}}}}$

See comment on last page. ND Parameter not detected. NR Parameter not requested. ** See comment on last page.
() Parameter between LOD and LOQ.

Analyst: Fred M. Rejali

Reviewer: Jeff R. Scott

Laboratory Supervisor: Daniel J. Bruch

960 West LeVoy Drive / Salt Lake City, Utah 84123-2547 / (801) 266-7700 A Sorenson Company



Form ARF-BL

2 2 Page of Part 1 of

Date	9117/91
	Identification Number 91-2715

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID					
ESDIS082691	CL.20140	CT	ND*	ND*	ND*			-		
ES-3004-P	CL 20141	CT	0.02	ND*	ND*	 ,				
ES-3005	CL 20142	CT	ND*	ND*	ND*			ļ		
ES5A083091P	CL 20143	CT	ND*	ND*	ND*					
ES5B083091P	CL 20144	CT	0.03	ND*	ND*					
ES5C083091P	CL 20145	CT	ND*	ND*	ND*					
ES6A083091P	CL 20146	CT	ND*	ND*	ND*					
ES6B083091P	CL 20147	CT	0.02	ND*	ND*					
ES6C083091P	CL 20148	CT	0.01	ND*	ND*					
ES7A083091P	CL 20149	CT	ND*	ND*	ND*					
ES7B083091P	CL 20150	CT	0.03	ND*	ND*					
ES7C083091P	CL 20151	СТ	0.03	ND*	ND*					
ES8A083091F	CL 20152	СТ	ND*	ND*	ND*					
ES8B083091P	CL 20153	CT	0.01	ND*	ND*					
ES8C083091P	CL 20154	CT	0.02	ND*	ND*					
ES-4000-P	CL 20155	CT	0.03	ND*	ND*					
ES-4001	CL 20156	CT	ND*	ND*	ND*					
RIP BLANK	CL 20157	CT	ND*	ND*	ND*					
Limit of D	etection		0.01	0.01	0.001			Jan Segara		
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See comment on last page.
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Form ARF-AL

1 of Page 1 of Part

Date	91	17/91
Agency	Identification	Number <u>91-2776</u>
Account	No. 03019	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX Telephone (303) 694-2770

Sampling	Collection	and	Shipment
----------	------------	-----	----------

Sampling Site _____ Date of Collection September 03, 1991 Date Samples Received at DataChem September 05, 1991 Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022 Date(s) of Analysis September 12, 1991

Analytical Results

Analysis

Milarytical	. Nesures								 	٦.
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene GC/FID	vinyl Chloride MG/SAMPLE GC/FID			·		
5A-090391-P	CL 20593	CT	ND*	ND*	ND*					上
5B-090391-P	CL 20594	CT	0.01	ND*	ND*					L
5C-090391-P	CL 20595	CT	0.02	ND*	ND*					$oxed{oldsymbol{ol}}}}}}}}}}}}}}}}}}$
6A-090391-P	CL 20596	СТ	ND*	ND*	ND*					<u> </u>
6B-090391-P	CL 20597	CT	ND*	ND*	ND*					1_
6C-090391-P	CL 20598	CT	0.01	ND*	ND*					_
7A-090391-P	CL 20599	CT	ND*	ND*	ND*					┶
7B-090391-P	CL 20600	CT	ND*	ND*	ND*					$oldsymbol{ol}}}}}}}}}}}}}}}}}}$
7c-090391-P	CL 20601	CT	0.11	ND*	ND*		1			1_
8A-090391-P	CL 20602	CT	ND*	ND*	ND*					<u> </u>
8B-090391-P	CL 20603	CT	0.01	ND*	ND*					1
8C-090391-P	CL 20604	CT	ND*	ND*	ND*		!		 :	<u> </u>
DIS-090391-P	CL 20605	CT	ND*	ND*	ND+	!	•		 •	

See comment on last page. ND Parameter not detected. NR Parameter not requested.

** See comment on last page.
() Parameter between LOD and LOQ.

Reviewery Jeff



Form ARF-BL

Page 2 of 2 Part 1 of 1

Date	9117/91
	Identification Number 91-2776

Analytical Results

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride Mg/SAMPLE GC/FID					
ES4-090391P	CL 20606	CT	0.12	ND*	ND*					
ES-5000-P	CL 20607	СТ	0.10	ND*	ND*					
ES-5001	CL 20608	CT	ND*	ND*	ND*					
RIP BLANK	CL 20609	CT	ND*	ND*	ND*				ejs flett of a st	
Limit of E	etection		0.01	0.01	0.001					
							-	:	:	
	 	-				1			1	



Form ARF-AL

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1991

1 of Part

Date 9/17/91	
Agency Identification Number 91-2824	
Account No. 03019	_

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX		
Telephone	(303) 694-2770	

Sampling C	offection and surpment	_
	Sampling Site Date of Collection September 09, 1992	L
	Date Samples Received at DataChem <u>September 10, 1991</u>	
Analysis	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022	

Date(s) of Analysis September 12, 1991

Analytical	l Results						 		٦.
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID				
5A-090991-B	CL 20879	CT	ND*	ND*	ND*				\perp
5B-090991-B	CL 20880	CT	ND*	ND*	ND*				$oldsymbol{\perp}$
5C-090991-B	CL 20881	CT	ND*	ND*	ND*				ــــــــــــــــــــــــــــــــــــــ
6A-090991-B	CL 20882	CT	ND*	ND*	ND*				↓_
6B-090991-B	CL 20883	CT	ND*	ND*	ND*		 	ļ	╄
6C-090991-B	CL 20884	CT	ND*	ND*	ND*				╄
7A-090991-B	CL 20885	CT	ND*	ND*	ND*				↓_
7B-090991-B	CL 20886	CT	ND*	ND*	ND*				↓_
7C-090991-B	CL 20887	CT	ND*	ND*	ND*				1_
8A-090991-B	CL 20888	CT	ND*	ND*	ND*				$oldsymbol{\perp}$
8B-090991-B	CL 20889	CT	ND*	ND*	ND*		1		\perp
8C-090991-B	CL 20890	CT	ND*	ND*	ND.*		 :		1_
DIS-090991-E	CL 20891	CT	ND*	ND*	ND*				\perp

See comment on last page. ND Parameter not detected. NR Parameter not requested.

Analyst: Fred M.

Reviewer:

Laboratory Supervisor: Daniel J. Bruch

960 West LeVoy Drive / Salt Lake City, Utah 84123-2547 / (801) 266-7700 A Sorenson Company

^{**} See comment on last page.
() Parameter between Lob and Log.



Form ARF-BL

Page 2 of 2 Part 1 of 1

Date 9/17/G/	
Agency Identification Number 91-2824	

Analytical Results

Analytical	Results										1
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID						
VES4-090991B	CL 20892	CT	ND*	ND*	ND*						<u> </u>
VES-5002-B	CL 20893	CT	ND*	ND*	ND*						_
	CL 20894	CT	ND*	ND*	ND*						_
	CL 20895	CT	ND*	ND*	ND*						
5C-090991-P	CL 20896	CT	0.01	ND*	ND*						L
6A-090991-P	CL 20897	CT	ND*	ND*	ND*						L
6B-090991-P	CL 20898	СŤ	ND*	ND*	ND*						L
6C-090991-F	CL 20899	CT	0.01	ND*	ND*						L
7A-090991-P	CL 20900 .	CT	ND*	ND*	ND*						_
7B-090991-P	CL 20901	CT	ND*	ND*	ND*						ļ
7C-090991-F	CL 20902	CT	ND*	ND*	ND*						L
8A-090991-P	CL 20903	CT	ND*	ND*	ND*						↓
8B-090991-P	CL 20904	ст	ND*	ND*	ND*						ot
8C-090991-P	CL 20905	CT	0.03	ND*	ND*						
DIS-090991-P	CL 20906	CT	ND*	ND*	ND*						
VES4-090991P	CL 20907	CT	0.08	ND*	ND*						igapha
VES-5002-P	CL 20908	CT	0.05	ND*	ND*						\perp
TRIP BLANK	CL 20909	CT	ND*	ND*	ND*						igapha
VES-5003	CL 20910	CT	ND*	ND*	ND*						╀-
* Limit of D	etection	y Addition	0.01	0.01	0.001			4712.			
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SEP 2 7 1991

Form ARF-AL

1 of Page of Part 1

WCC/DENVER, COLORADO

Date	9/23/91	
Agency	Identification Number 91-2912	
Accoun	t No. 03019	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX		
Telephone	(303)	694-2770

Sampling	Collection and Shipment Sampling Site Date of Collection September 16, 1991	
	Date Samples Received at DataChem <u>September 17, 1991</u>	_
Analysis	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022	
	Date(s) of Analysis September 20, 1991	

Analytical Results

Analytical	Resures					 	 		1
Field Sample Number	Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID				
5A-091691-P	CL 21465	CT	ND*	ND*	ND*				
5B-091691-P	CL 21466	CT	ND*	ND*	ND*				—
5C-091691-P	CL 21467	CT	ND*	ND*	ND*				
6A-091691-P	CL 21468	CT	ND*	ND*	ND*			-	
6B-091691-P	CL 21469	CT	ND*	ND*	ND*				\vdash
6C-091691-P	CL 21470	CT	ND*	ND*	ND*				╀
7A-091691-P	CL 21471	CT	ND*	ND*	ND*			-	
7B-091691-P	CL 21472	CT	ND*	ND*	ND*			-	
7C-091691-P	CL 21473	CT	ND*	ND*	ND*		 		\downarrow
8A-091691-P	CL 21474	CT	ND*	ND*	ND*		-		╀
	CL 21475	CT	ND*	ND*	ND*				┼
8C-091691-P	CL 21476	CT	ND*	ND*	ND*				\vdash
VES4-091691P	CL 21477	CT	0.07	ND*	ND*				丄

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^{**} See comment on last page.
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Form ARF-BL

2 Page 2 of

1 of 1 Part

Date	9/23/91
Agency	Identification Number 91-2912

Analytical Results

Analytical	Results					1			1		l
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID						
DIS-091691-P	CL 21478	CT	ND*	ND*	ND*						_
VES-5004-P	CL 21479	CT	ND*	ND*	ND*						-
VES-5005	CL 21480	СТ	ND*	ND*	ND*						┞
TRIP BLANK	CL 21481	CT	ND*	ND*	ND*						\vdash
5A-091691-B	CL 21482	CT	ND*	ND*	ND*						┞
5B-091691-B	CL 21483	CT	ND*	ND*	ND*						 - -
5c-091691-B	CL 21484	CT	ND*	ND*	ND*						╀
6A-091691-B	CL 21485	ст	ND*	ND*	ND*						╀
6B-091691-B	CL 21486	ст	ND*	ND*	ND*						┼
6C-091691-B	CL 21487	ст	ND*	ND*	ND*						
7A-091691-B	CL 21488	СТ	ND*	ND*	ND*						ļ.
7B-091691-B	CL 21489	СТ	ND*	ND*	ND*						╀
7c-091691-B	CL 21490	СТ	ND*	ND*	ND*						╀
8A-091691-B	CL 21491	CT	ND*	ND*	ND*						\vdash
8B-091691-B	CL 21492	CT	ND*	ND*	ND*						┼
8C-091691-B	CL 21493	CT	ND*	ND*	ND*			_			+-
VES4-091691	B CL 21494	CT	ND*	ND*	ND*			<u> </u>			╀
VES-5004-B	CL 21495	CT	ND*	ND*	ND*						+
DIS-091691-1	B CL 21496	СТ	ND*	ND*	ND*						+
* Limit of 1	Detection		0.01	0.01	0.001						╀
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Form ARF-AL

1 of Page 1 of Part

Agency Identification Number 91-2985 Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

Telephone (303) 694-2770

Sampling Collection and Shipment

Date of Collection September 20, 1991 Sampling Site ____

Date Samples Received at DataChem September 24, 1991

Analysis

Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022

Date(s) of Analysis September 28, 1991

Analytical Results

					Φ					
Field Sample Number	DataChem Lab Number	Sample Type	rrichloro ethylene mg/sample GC/FID	1,2-Dichloro ethylene mg/sample GC/FID	vinyl Chlorid mg/sample GC/FID					
5A-092091-P	CL 21942	CT	ND*	ND*	ND*					ot
5B-092091-P	CL 21943	CT	ND*	ND*	ND*					\vdash
5c-092091-P	CL 21944	CT	ND*	ND*	ND*					╀
6A-092091-P	CL 21945	CT	ND*	ND*	ND*	 				╀
6B-092091-P	CL 21946	CT	ND*	ND*	ND*				1	╀
6C-092091-P	CL 21947	CT	0.02	ND*	ND*					╁-
7A-092091-P	CL 21948	CT	ND*	ND*	ND*					╀-
7B-092091-P	CL 21949	CT	ND*	ND*	ND*					╀-
8A-092091-P	CL 21950	CT	ND*	ND*	ND*			-		╀-
8B-092091-P	CL 21951	CT	0.01	ND*	ND*					4-
8C-092091-P	CL 21952	СТ	NĎ*	ND*	ND*		_			4
7c-092091-P	CL 21953	CT	0.03	ND*	ND*			!		┼-
VES-5006-P	CL 21954	CT	ND*	ND*	ND*	!				

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NR Parameter not requested.

Laboratory Supervisor: Daniel J. Bruch

960 West LeVoy Drive / Salt Lake City, Utah 84123-2547 / (801) 266-7700 A Sorenson Company

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Form ARF-BL

Page 2 of 2 Part 1 of 1

Date	10/8/9	1	
		1	
Agency	Identification	Number <u>91-2985</u>	

Analytical Results

	Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethylene mg/sample GC/FID	Vinyl Chloride mg/sample GC/FID						
-	5-5005	CL 21955	CT	ND*	ND*	ND*						
			CT	ND*	ND*	ND*						
	-092091-B	CL 21957	CT	ND*	ND*	ND*						
—			CT	ND*	ND*	ND*						
		CL 21959	CT	ND*	ND*	ND*						
	-092091-B	CL 21960	CT	ND*	ND*	ND*						
	-092091-B -092091-B	CL 21961	CT	ND*	ND*	ND*						
		CL 21962	CT	ND*	ND*	ND*						
		CL 21963	CT	ND*	ND*	ND*						
-	-092091-B -092091-B		CT	ND*	ND*	ND*						
		CL 21965	CT	ND*	ND*	ND*						
		CL 21966	СТ	ND*	ND*	ND*						L
		CL 21967	CT	ND*	ND*	ND*						L
	S-5006-B	CL 21968	СТ	ND*	ND*	ND*						L
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Form ARF-AL

Page 1 of Part 1 of

Date	10/8/0	त्।	
	 7 7 7	Number <u>91-3022</u>	
Account			

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX	
Telephone	(303) 694-2770

Sampling	Collection	and	Shipment	
	Sampling	Site		Da

ate of Collection September 23, 1991

Date Samples Received at DataChem September 27, 1991

Analysis

Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022

Date(s) of Analysis September 28, 1991

Analystical Popults

Analytical										1
field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethylene mg/sample GC/FID	vinyl Chloride mg/sample GC/FID					
5A-092391-P	CL 22260	CT	ND*	ND*	ND*					_
5B-092391-P	CL 22261	CT	0.02	ND*	ND*					1
5C-092391-P	CL 22262	CT	0.02	ND*	ND*					↓_
6A-092391-P	CL 22263	CT	ND*	ND*	ND*					\vdash
6B-092391-P	CL 22264	CT	ND*	ND*	ND*					<u> </u>
6C-092391-P	CL 22265	CT	0.04	ND*	ND*		ļ			\perp
7A-092391-P	CL 22266	CT	ND*	ND*	ND*			<u> </u>		<u> </u>
7B-692391-P	CL 22267	CT	ND*	ND*	ND*					<u> </u>
7c-092391-P	CL 22268	CT	ND*	ND*	ND*					1_
8A-092391-P	CL 22269	CT	ND*	ND*	ND*				ļ	1_
8B-092391-P	CL 22270	CT	0.01	ND*	ND*				-	↓_
8C-092391-P	CL 22271	CT	0.03	ND*	ND*			1	1	$oldsymbol{\perp}$
VES3-092391P	CL 22272	CT	0.10	ND*	ND*				1	\perp

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Page 2 of 2

Part 1 of 1

Date	10/8/91
	Identification Number 91-3022

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethylene mg/sample GC/FID	Vinyl Chloride mg/sample GC/FID			
DIS-092391-P	CL 22273	CT	ND*	ND*	ND*			\downarrow
7ES-5008-P	CL 22274	CT	ND*	ND*	ND*			1
VES-5009	CL 22275	CT	ND*	ND*	ND*			1
* Limit of D	etection		0.01	0.01	0.001			+
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Form ARF-AL

Page 1 of 2 Part 1 of 1

Date	10/11/91	
Agency Ident	10/11/Q Lification Number 91-308	7
Account No.		

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

Sampling	Sampling Site Date of Collection October 01, 1991
	Sampling Site
	Date Samples Received at DataChem October 03, 1991
Analysis	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022
	Date(s) of Analysis October 06, 1991 - October 07, 1991

Analytical Results

Analytical	. ACDULEO					 T	T			I
Field Sample Number	DataChem Lab Number	sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	vinyl Chloride MG/SAMPLE GC/FID					
5A-100191-P	CL 22904	CT	ND*	ND*	ND*					╀
	CL 22905	CT	0.03	ND*	ND*					╀
5C-100191-P		CT	0.07	ND*	ND*					╀╌
6A-100191-P	CL 22907	CT	ND*	ND*	ND*			ļ		╀
6B-100191-P	CL 22908	CT	0.04	ND*	ND*					╀
6C-100191-P	CL 22909	CT	0.11	ND*	ND*	 				╀
7A-100191-P	CL 22910	CT	ND*	ND*	ND*		-			+
7B-100191-P		CT	0.04	ND*	ND*					╁
7C-100191-P		CT	0.09	ND*	ND*					╀
8A-100191-P		CT	ND*	ND*	ND*					╀
8B-100191-P	CL 22914	CT	0.03	ND*	ND*		1		-	╁
8c-100191-P	CL 22915	CT	ND*	ND*	ND*					+
VES-5010-P	CL 22916	CT	0.08	ND*	ND*	1				

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() Parameter between LOD and LOQ.

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Analyst: Fred M. Rejali	
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Reviewer Jeff R. Scott	
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Form ARF-BL

Page 2 of 1 of 1 Part

Agency Identification Number 91-3087

Analytical	Results									
Field Sample Number		Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID					<u> </u>
VES3-100191P	CL 22917	CT	0.08	ND*	ND*					-
DIS-100191-P		CT	ND*	ND*	ND*	-				\mathbf{H}
VES-5011	CL 22919	CT	ND*	ND*	ND*					
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Form ARF-AL

Page 1 of of 1 Part 1

Date _	10/15/91	
	Identification	Number <u>91-3141</u>
Account	No. 03019	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX		
Telephone	(303)	694-2770

Sampling	Collection and Shipment	
	Sampling Site	Date of Collection October 07, 1991
	Date Samples Received at DataChem	<u>October 08, 1991</u>
	•	
Analysis		

Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022

Date(s) of Analysis October 12, 1991 - October 13, 1991

Analytical Results

Analytica.	I Results				-		 	 	٦
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID				
5A-100791-F	CL 23344	CT	ND*	ND*	ND*				1
5B-100701-1	CL 23345	CT	0.04	ND*	ND*				↓_
5c-100791-F	CL 23346	CT	0.02	ND*	ND*			<u> </u>	╀
6A-100791-F	CL 23347	CI	ND*	ND*	ND*				\perp
6B-100791-F	CF 53348	CT	0.05	ND*	ND*			1	⊥
6C-100791-F	CL 23349	CT	0.08	ND*	ND*				\perp
7A-100791-F	CL 23350	CT	ND*	ND*	ND*				\perp
7B-100791-F	CL 23351	CT	0.06	ND*	ND*				\perp
7C-100791-F	CL 23352	CT	0.13	ND*	ND*				1
8A-100791-F	CL 23353	CT	ND*	ND*	ND*	<u> </u>		<u> </u>	\perp
8B-100731-F	CL 23354	CT	0.03	ND*	ND*		-	 	\perp
8C-100791-F	CL 23355	CT	0.09	ND*	ND*			t .	\perp
VES3100791-1	PCL 23356	CT	0.09	ND*	ND*				

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() Parameter between LOD and LOQ.

Analyst: Fred

Reviewer:

Laboratory Supervisor: Daniel J. Bruch



Form ARF-BL

Page 2 of Part 1 of 1

Date _	10/15/91
Agency	Identification Number 91-3141

Analytical Results

Analytica.	resures							
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID			
DIS-100791-P	CL 23357	CT	ND*	ND*	ND*			十
VES-5012-P	CL 23358	CT	0.15	ND*	ND*			十
VES-5013	CL 23359	CT	ND*	ND*	ND*			十
* Limit of D	etection		0.01	0.01	0.001			+
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Form ARF-AL

1 Page of of Part 1

Agency Identification Number 91-3229 Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX Telephone (303) 694-2770

Sampling (Collection and Shipment Sampling Site Date of Collection October 11, 1991
	Date Samples Received at DataChem October 16, 1991
Analysis	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022
	Date(s) of Analysis October 20, 1991

Analytical Results

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID					
5A-101191-P	CL 24395	CT	ND*	ND*	ND*					Ш
5B-101191-P	CL 24396	CT	0.03	ND*	ND*					\sqcup
	CL 24397	CT	0.09	ND*	ND*					\sqcup
6A-101191-P	CL 24398	CT	ND*	ND*	ND*					Ш
6B-101191-P	CL 24399	CT	0.04	ND*	ND*					
6C-101191-P	CL 24400	CT	0.12	ND*	ND*					
7A-101191-P	CL 24401	CT	ND*	ND*	ND*		<u> </u>			\sqcup
	CL 24402	CT	0.04	ND*	ND*					
7c-101191-F	CL 24403	CT	0.11	ND*	ND*		<u> </u>			<u> </u>
8A-101191-P	CL 24404	CT	ND*	ND*	ND*		<u> </u>	-	1	<u> </u>
	CL 24405	CT	ND*	ND*	ND*		:			-
8C-101191-P	CL 24406	CT	0.09	ND*	ND*		: 	1		ـــــــــــــــــــــــــــــــــــــ
VES-5014-P	CL 24407	CT	0.12	ND*	ND*		<u> </u>	<u> </u>		上

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Reviewer: Jest

Laboratory Supervisor: Daniel J. Bruch



Form ARF-BL

2 of Page of Part 1

Agency Identification Number 91-3229

Analytica	l Results										1
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID						
VES-5015	CL 24408	CT	ND*	ND*	ND*						\perp
TRIP BLANK	CL 24409	CT	ND*	ND*	ND*						igdash
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Form ARF-AL

1 of Page 1 of Part

Agency Identification Number 91-3230 Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX	
Telephone	(303) 694-2770

Sampling	Collection and Shipment Sampling Site Date of Collection October 15, 1991
	Date Samples Received at DataChem October 16, 1991
Analysis	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022
	Date(s) of Analysis October 20, 1991

Analytical Results

Miaryticar	Results					 			-	1
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID					
5A-101591-P	CL 24410	CT	ND*	ND*	ND*					Ш
5B-101591-P	CL 24411	CT	0.02	ND*	ND*					Ш
5C-101591-P	CL 24412	CT	0.04	ND*	ND*				ļ	
6A-101591-P	CL 24413	CT	ND*	ND*	ND*					Ш
6B-101591-P	CL 24414	CT	0.02	ND*	ND*					
6C-101591-P	CL 24415	CT	0.07	ND*	ND*				ļ	
7A-101591-P	CL 24416	CT	ND*	ND*	ND*					┞
7B-101591-P	CL 24417	CT	0.02	ND*	ND*					_
7C-101591-P	CL 24418	CT	ND*	ND*	ND*					↓_
8A-101591-P	CL 24419	CT	ND*	ND*	ND*				!	↓_
8B-101591-P	CL 24420	CT	0.02	ND*	ND*		!			\perp
8C-101591-P	CL 24421	CT	0.12	ND*	ND*			<u> </u>	12.11.	<u> </u>
DIS-101591-P	CL 24422	CT	ND*	ND*	ND*		1	!		

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Analyst:

Reviewer:

Laboratory Supervisor: Daniel J. Bruch



Form ARF-BL

2 of Page Part 1 of 1

	10/24/91	
Date	Identification Number 91-3230	
Agency	Identification Number 31-3230	_

Field Sample Number	pataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID						
ES4-101591P	CL 24423	CT	0.07	ND*	ND*						+
ES-5018-P	CL 24424	CT	0.11	ND*	ND*						+
ES-5017	CL 24425	CT	ND*	ND*	ND*						+
Limit of D	etection		0.01	0.01	0.001						+
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Form ARF-AL

2 1 of Page of 1 Part

Date	11	11/91	Number <u>91-3369</u>	_
Agency	Ident:	ification	Number <u>91-3369</u>	
Account				

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX		
Telephone	(303)	694-2770

Sampling	Collection and Shipment Sampling Site	Date of Collection October 21, 1991
	Date Samples Received at DataChem	October 25, 1991
Analysis	Method of Analysis GC/FID	91

Analytical Results

Analytical	Results				,		-	i	1
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample						
5A-102191-P	CL 25551	CT	ND*			ļ			ļ
5B-102191-P	CL 25552	CT	ND*					-	⊢
5c-102191-P	CL 25553	CT	0.03			ļ			
6A-102191-P	CL 25554	CT	ND*						↓_
6B-102191-P	CL 25555	CT	ND*						╁
6C-102191-P	CL 25556	CT	ND*						╀
7A-102191-P	CL 25557	CT	ND*						
7B-102191-P	CL 25558	CT	ND*						╄
7c-102191-P	CL 25559	CT	ND*						╀-
8A-102191-P	CL 25560	CT	ND*					-	┼
8B-102191-P	CL 25561	CT	ND*						╀
8C-102191-P	CL 25562	CT	ND*	 !				-	╀
DIS-102191-F	CL 25563	CT	ND*			}			上

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Laboratory Supervisor:

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Page 2 of Part · 1 of 1

Agency Identification Number 91-3369

Field Sample Number		Sample Type	Trichloro ethylene mg/sample			·					
/ES4-102191F	CL 25564	СТ	0.08								L
/ES-5018-P	CL 25565	CT	ND*						<u> </u>		ļ
/ES-5019	CL 25566	CT	ND*						_		\vdash
Limit of I	etection		0.01					at. Prand I			\vdash
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Form ARF-AL

Page 1 of 1 of Part

Agency Identification Number 91-3395 Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX			
Telephone	(303)	694-2770	

Sampling	Collection and Shipment
	Sampling Site Date of Collection October 28, 1991
	Date Samples Received at DataChem October 29, 1991
Analysis	
	Method of Analysis GC/FID
	Date(s) of Analysis October 30, 1991

Analytical ield Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample					
5A-102891-F	CL 25734	СТ	ND*					I
5B-102891-P	CL 25735	CT	ND*					\downarrow
5C-102891-P	CL 25736	CT	ND*					1
6A-102891-P	CL 25737	CT	ND*					1
6B-102891-P	CL 25738	CT	ND*					1
6C-102891-P	CL 25739	CT	ND*					1
7A-102891-P	CL 25740	CT	ND*					1
7B-102891-P	CL 25741	CT	ND*					1
7C-102891-P	CL 25742	CT	ND*					1
8A-102891-P	CL 25743	CT	ND*					1
8B-102891-P	CL 25744	CT	0.02				1	1
8C-102891-P	CL 25745	CT	ND*					1
VES4-1028911	CL 25746	CT	0.07					1

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Laboratory Supervisor:



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Page 2 of 2

Part 1 of 1

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Agency Tdentifi	cati	on	Number <u>91-3395</u>

Analytical Results

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample						
			Tricethy mg/s						igdash
DIS-102891-P	CL 25747	СТ	ND*						╀
/ES-5020-P	CL 25748	CT	ND*					 1	╀
/ES-5021	CL 25749	CT	ND*			The main of the			+
Limit of D	etection		0.01			# 1			╀
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WCC/DENVER COLORADO	11/8/9/	
Agency Identific	cation Number 91-3448	
Account No030	019	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX		
Telephone	(303)	694-2770

Sampling (Collection a Sampling S	ind Shi	pment		D	ate of	Collect	ion No	vember ()1, 1991
	Date Sampl	es Rec	eived a	t DataC	hem <u>Nov</u>	ember O	4, 1991			
Analysis	Method of Date(s) of				, 1991					
Analytical	Results									
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample							
5A-110191-P	CL 26158	CT	ND*							
5B-110191-P	CL 26159	CT	ND*						<u> </u>	
5c-110191-P	CL 26160	CT	ND*							-
6A-110191-P	CL 26161	CT	ND*							
6B-110191-P	CL 26162	CT	ND*							-
6C-110191-P	CI 26163	CT	ND*							
7A-110191-P	CL 26164	CT	ND*							-
7B-110191-P	CL 26165	CT	ND*							
7C-110191-P	CL 26166	CT	ND*							
8A-110191-P	CL 26167	CT	ND*							
8B-110191-P	CL 26168	CT	ND*							
8C-110191-P	CL 26169	CT	ND*						ļ <u>.</u>	-
VES-5022-P	CL 26170	CT	ND*						1	

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Laboratory Supervisor:

Reviewer:



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2 of Page Part 1 of 1

Date /	1/8/91
Agency Identification	Number 91-3448

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample				
ES-5023	CL 26171	CT	ND*				
Limit of D	etection		0.01				
			•				

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1 Page of

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Date	1.	1/18/91		
			Number <u>91-3494</u>	
Account	No.	03019		

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX Telephone (303) 694-2770

Sampling	Collection and Shipment Sampling Site Date of Collection November 04, 1991
	Date Samples Received at DataChem November 07, 1991
Analysis	
	Method of Analysis GC/FID
	Date(s) of Analysis November 10, 1991 - November 13, 1991

Analytical Field Sample Number		Sample Type	loro ene mple						
			Trichloro ethylene mg/sample						\downarrow
5A-110491-P	CL 26482	CT	ND*						ļ
5B-110491-P	CL 26483	CT	ND*						╀
5C-110491-P	CL 26484	CT	ND*					1	╀
6A-110491-P	CL 26485	CT	ND*			•			+
6B-110491-P	CL 26486	CT	ND*					<u> </u>	+
6C-110491-P	CL 26487	CT	ND*						╀
7A-110491-P	CL 26488	CT	ND*						+
7B-110491-P	CL 26489	CT	ND*					ļ	+
7c-110491-P	CL 26490	CT	ND*						+
8A-110491-P	CL 26491	CT	ND*					1	+
8B-110491-P	CL 26492	CT	ND*						+
8C-110491-P	CL 26493	CT	ND*					<u> </u>	+
VES4-110491F	CL 26494	CT	0.08				1		\perp

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Laboratory Supervisor: Daniel J. Bruch



Form ARF-BL

Page 2 of 2 Part 1 of 1

	11/18/91	
Date		
Agency	Identification	Number 91-3494

Field Sample Number	DataChem Lab Number		Trichloro ethylene mg/sample					
IS-110491-F	CL 26495	СТ	ND*					T
	CL 26496	СТ	0.03				-	十
7ES-5025	CL 26497	CT	ND*					+
Limit of	etection		0.01					-
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DataChem Laboratories

Quality Control Data Sheet

Batch ID 1991-6084

Analyte Analyst Name Analyst Number Method Results in

Range Range Range Range Range Trichloroethylene JENSEN A 5 3 51 I GC/FID mg/sample Mean Below Below Below Below Below Below -0.0012 -0.0012 -0.0012 -0.0029 0.2791 0.5494 Values Sample BLANK

CL 26482A CL 26488A QC40579 QC40583

Matrix Instrument Date

14-NOV-1991 14:57

Status

Range/Mean

Range

Target

0.0013 I I 0.0027

0.0014 0.0004

0.2750 0.5490

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WCC/DENVER, COLORADO Date

Agency Identification Number 91-3549

Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX Telephone (303) 694-2770

Sampling	Collection	and	Shipment
	Sampling	Site	

Date of Collection November 11, 1991 Date Samples Received at DataChem November 12, 1991

Analysis

Method of Analysis NIOSH 1022

Date(s) of Analysis November 16, 1991 - November 17, 1991

Analytical Results

rield Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample		,			
5A-111191-P	CL 27241	CT	ND*					L
5B-111191-P	CL 27242	CT	ND*					ــــــــــــــــــــــــــــــــــــــ
5C-111191-P	CL 27243	CT	ND*				 	$oldsymbol{ol}}}}}}}}}}}}}}}}}}$
6A-111191-P	CL 27244	CT	ND*					╄
6B-111191-P	CL 27245	CT	ND*					<u> </u>
6C-111191-P	CL 27246	CT	ND*				 	↓_
7A-111191-P	CL 27247	CT	ND*					┺
7B-111191-P	CL 27248	CT	ND*				ļ <u>.</u>	┺
7c-111191-P	CL 27249	CT	ND*					╀
8A-111191-P	CL 27250	CT	ND*					\perp
8B-111191-P	CL 27251	CT	ND*				ļ	$oldsymbol{\perp}$
8C-111191-P	CL 27252	CT	ND*					╄
VES4-111191	PCL 27253	CT	0.08					\perp

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Laboratory Supervisor:

960 West LeVoy Drive / Salt Lake City, Utah 84123-2547 / (801) 266-7700 A Sorenson Company



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2 of Page

Part 1 of

Agency Identification Number 91-3549

Analytical	Results					T			1		ļ
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample								
DIS-111191-P	CL 27254	CT	ND*								_
	CL 27255	CT	ND*								L
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Page 1 of 2 Part 1 of 1

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

Sampling	Collection and Shipment Sampling Site Date of Collection November 18, 1991
	Date Samples Received at DataChem <u>November 20, 1991</u>
Analysis	
	Method of Analysis NIOSH 1022
	Date(s) of Analysis November 22, 1991

Analytical Results

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample						
5A-111891-P	CL 27607	CT	ND*				-		\dagger
	CL 27608	CT	ND*			ļ			\dagger
	CL 27609	CT	ND*			 		-	\dagger
6A-111891-P	CL 27610	CT	ND*					-	+
6B-111891-P	CL 27611	CT	ND*						+
6C-111891-P	CL 27612	CT	ND*						\dagger
7A-111891-P	CL 27613	CT	ND*			-	 		\dagger
7B-111891-P		CT	ND*				-		+
7C-111891-P	CL 27615	CT	ND*					+	+
	CL 27616	CT	ND*			-		1	+
8B-111891-P	CL 27617	CT	ND*			-			-
8C-111891-P	CL 27618	CT	ND*					 	\dashv
VES4-1118911		CT	0.07						لـ

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Analyst: Paul C. Gillespie

Reviewer:

Laboratory Supervisor:



Form ARF-BL

Page 2 of 2 Part 1 of 1

Date			11	27	191	
	Identification	Number 9	11-	3603/		

Analytical	Results								1
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample						
IS-111891-F	CL 27620	СТ	ND*						\vdash
	CL 27621	CT	ND*						\vdash
	CL 27622	CT	ND*						-
Limit of E	etection		0.02						T
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Part 1

1991

Date ^(C)	12	11: 171		
Agency	Identi	Eication	Number <u>91-3713</u>	
Account	_			

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX	
Telephone	(303) 694-2770

Sampling	Collection and Shipment Sampling Site Date of Collection December 02. 1991
	Date Samples Received at DataChem <u>December 04, 1991</u>
Analysis	Method of Analysis NIOSH 1022
	Date(s) of Analysis <u>December 06, 1991</u>

Analytical Regults

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID						
5A-120291-P	CL 28419	CT	ND*	<u> </u>					-
5B-120291-P	CL 28420	CT	ND*					1	.
5C-120291-P	CL 28421	CT	ND*						
6A-120291-F	CL 28422	СТ	ND*						
6B-120291-F	CL 28423	CT	ND*				 		-
6C-120291-P	CL 28424	CT	ND*				<u> </u>		1
7A-120291-P	CL 28425	C1	ND*	 	 	<u> </u>	<u> </u>	 	-
7B-120291-F	CL 28426	CT	ND*						-
7c-120291-F	CL 28427	CT	0.06				-		+
8A-120291-F	CL 28428	CT	ND*				-	<u> </u>	
8B-120291-P	CL 28429	CT	0.01					-	
8C-120291-P	CL 28430	CT	0.08						
DIS-120291-	PCL 28431	CT	ND*						丄

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Analyst: F

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Page 2 of 2

Part 1 of 1

Date	13-11/9	/
	Identification	

Analytical Results

Analytical											
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Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID								
E54-120291P	CL 28432	CT	0.08								
	CL 28433	CT	ND*	<u> </u>					i 	!	-
ES-5031	CL 28434	СТ	ND*								-
Limit of D	etection		0.01				i ji				1
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Page of Part of 1

Agency Identification Number 91-3757 Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX				_
Telephone	(303)	694	-2770	

Sampling	Collection and Shipment Sampling Site	Date of Collection <u>December 09, 1991</u>
	Date Samples Received at Data	Chem <u>December 10, 1991</u>
Analysis	Method of Analysis NIOSH 1022	
	Date(s) of Analysis December 1	4. 1991

Analytical Results

Analytical	resuits			 	 			٦.
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID					
5A-120991-P	CL 28834	CT	ND*					ļ
5B-120991-P	CL 28835	CI	ND*					ļ
5C-120991-P	CL 28836	CT	ND*					
6A-120991-P	CL 28837	CT	ND*					1
6B-120991P	CL 28838	CT	ND*					<u> </u>
6C-120991-P	CL 28839	CT	ND*					ļ
7A-120991-F	CL 28840	CT	ND*					1
7B-120991-P	CL 28841	CT	ND*					
7C-120991-P	CL 28842	CT	0.03					<u> </u>
8A-120991-P	CL 28843 .	CT	ND*					
8B-120991-P	CL 28844	CT	ND*					1.
8C-120991-P	CL 28845	CT	0.02					
VES4-120991P	CL 28846	CT	0.05				<u>.</u>	

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Part 1 of 1

Analytical Results

	Results				1		ī · · · · · ·	,	· ·	7
Field Sample Number	DataChem Lab Number	sample Type	Trichloro ethylene mg/sample GC/FID							
DIS-120991-P	CI 38847	СТ	ND*				1	<u> </u>		Т
	CL 28848	CT	0.01							†"
	CL 28849	CT	ND*							† -
VES-5033 * Limit of D			0.01							T
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Agency Identification Number 91-3871 Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX Telephone (303) 694-2770

Sampling	Collection and Shipment Sampling Site Date of Collection December 10, 1991
	Date Samples Received at DataChem <u>December 17, 1991</u>
Analysis	Method of Analysis NIOSH 1022 Date(s) of Analysis December 21, 1991

Analytical Results

Analytical	Results				,	1		1			1
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID								
1s-121091-P	CL 30189	CT	ND*			ļ					†-
1M-121091-P	CL 30190	CT	0.39	<u> </u>		-			+		1
1D-121091-P	CL 30191	CT	0.66								T
25-121091-P	CL 30192	CT .	0.42					1			T
2M-121091-P	CL 30193	CT	0.01							-	+
	CL 30194	СТ	1.1								1
3S-121091-P	CL 30195	CT	0.11								+
3M-121091-P	CL 30196	CT	0.48							 	1-
3D-121091-P	CL 30197	СТ	1.2						-		\top
45-121091-F	CL 30198	CT	ND+	<u> </u>							+
4M-121091-F	CL 30199	CT	0.32	<u> </u>		!			 ·		1
4D-121091-F	CL 30200	CT	0.03	<u>. </u>		1					
55-121291-P		CT	nr,		mmen+ cn	last r	200				

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MD	Para	meter	not	detect	ea.

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M. Rejali

Laboratory Supervisor: Daniel J. Bruch



Form ARF-BL

Page 2 of 2 Part 1 of 1

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Date	. 12/23/91	-
Agency	Identification Number 91-3871	_

	nataChem		0 6						
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/SAMPLE GC/FID						
M-121291-P	CL 30202	CT	ND*						
D-121291-P	T	СТ	0.06		2000 mm		region of the		
Limit of D			0.01						
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Form ARF-AL

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1 of 1 Part

Agency Identification Number 91-3860 Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX Telephone (303) 694-2770

Sampling	Collection and Shipment	December 16 1991
	Sampling Site	Date of Collection <u>December 16, 1991</u>
	Date Samples Received at DataChem	December 17, 1991
Analysis		
	Method of Analysis NIOSH 1022	
	Date(s) of Analysis December 20, 19	991 - December 21, 1991

Analytical	Results			 			1	1	7
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID						
5A-121691-P	CL 30124	CT	ND*						-
5B-121691-P	CL 30125	СТ	ND+						-
5c-121691-P	CL 30126	CT	ND*						+
6A-121691-P	CL 30127	CT	ND*	 ļ		 	-	-	+-
6B-121691-P	CL 30128	CT	ND+						+-
6C-121691-P	CL 30129	CT	ND*	 			1	-	+
7A-121691-P	CL 30130	CT	ND*						- -
7B-121691-P	CL 30131	CT	ND*	 					\dashv
7c-121691-P	CL 30132	CT	0.01					-	1-
8A-121691-P	CL 30133	CT	ND*	 				·	
8B-121691-P	CL 30134	CT	ND+	 1		 			-
8C-121691-P	CL 30135	CT	0.02			 			
VES4-121691E	CL 30136	CT	0.08		:	 			

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Rejali Analyst: F

Laboratory Supervisor: Daniel J. Bruch

960 West LeVoy Drive / Salt Lake City, Utah 84123-2547 / (801) 266-7700 A Sorenson Company



Form ARF-BL

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Part 1 of 1

Date 17/23/9/ Agency Identification Number 91-3860

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID					-
IS-121691-P	CL 30137	CT	ND*					+
	CL 30138	CT	ND*					1
ES-5035	CL 30139	CT	ND*			Ball de Senioles est.		†
Limit of E	etection		0.01					+
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